DOCUMENT RESUME

ED 277 718 TM 860 729

AUTHOR Dangel, Timothy R.
TITLE Mathematics Program Evaluation. Final Report.
INSTITUTION Anne Arundel County Public Schools, Annapolis, Md.
PUB DATE Mar 85
NOTE 145p.; For a related document, see TM 860 728.
PUB TYPE Reports - Evaluative/Feasibility (142) -- Tests/Evaluation Instruments (160)

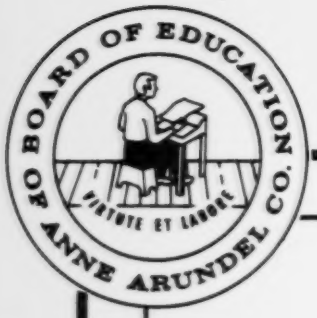
EDRS PRICE MF01/PC06 Plus Postage.
DESCRIPTORS Academic Achievement; Administrator Attitudes; Attitude Measures; Curriculum Evaluation; *Elementary School Mathematics; Elementary Secondary Education; Evaluation Methods; Evaluators; High School Graduates; *Mathematics Curriculum; *Mathematics Instruction; *Participant Satisfaction; Program Attitudes; *Program Evaluation; Questionnaires; *Secondary School Mathematics; Student Attitudes; Surveys; Teacher Attitudes
IDENTIFIERS Anne Arundel County Public Schools MD; California Achievement Tests

ABSTRACT

The model used to evaluate the mathematics curriculum of the Anne Arundel County Public Schools (Maryland) involved three phases: the curriculum; instruction, or the implementation of the curriculum; and students' attitudes, performance, and later success. The evaluation was conducted in 1984. Data were collected from seven sources: a review of the curriculum by five consultants, survey of current students, survey of former students, survey of school staff, survey of students enrolled in Algebra I as seventh graders, high school mathematics achievement data, and previously collected data which were available within the school system, such as student cumulative records, schedules, and teacher characteristics. About half of this document presents the results of the evaluation. Responses to questionnaire items are summarized, narrative comments are presented, and the source of the data is provided. Conclusions, observations, and recommendations were generally positive as far as appropriateness of the curriculum, graduate satisfaction, and degree of program implementation. The other half of the document contains the appended questionnaires for curriculum consultants, students, former students, students who took Algebra I in grade 7, principals and other administrators, guidance counselors, elementary school teachers, middle and junior high school teachers, and senior high school teachers. (GDC)

**********
* Reproductions supplied by EDRS are the best that can be made *
* from the original document. *
**********

ED277718




# Mathematics Program Evaluation

## *Final Report*

Anne Arundel County Public Schools

TM 860 729

U.S. DEPARTMENT OF EDUCATION
Office of Educational Research and Improvement
EDUCATIONAL RESOURCES INFORMATION CENTER (ERIC)

☐ This document has been reproduced as received from the person or organization originating it.

☒ Minor changes have been made to improve reproduction quality.

• Points of view or opinions stated in this document do not necessarily represent official OERI position or policy.

"PERMISSION TO REPRODUCE THIS MATERIAL HAS BEEN GRANTED BY

T. Dangel

TO THE EDUCATIONAL RESOURCES INFORMATION CENTER (ERIC)."

BEST COPY AVAILABLE

**MATHEMATICS PROGRAM EVALUATION**

**FINAL REPORT**

Submitted by the Office of Research
Timothy R. Dangel, Coordinator

March 1985

Table of Contents

| | | Page |
|---|---|---|
| INTRODUCTION | | 1 |
| I. | The Model and Process for Evaluating Curriculum Programs | 1 |
| A. | The Evaluation Model and Its Previous Uses | 1 |
| B. | The Request to Evaluate the Mathematics Program | 1 |
| II. | The Broad Research Questions | 1 |
| A. | The Mathematics Curriculum | 1 |
| B. | The Student--Mathematics Performance, Attitudes, and Later Success | 1 |
| C. | Mathematics Instruction | 2 |
| III. | The Evaluation Procedures | 2 |
| A. | Consultants | 2 |
| B. | Current and Former Students | 2 |
| C. | School Administrators, Counselors, and Teachers | 4 |
| D. | Achievement Test Scores | 4 |
| E. | Other Available Data | 5 |
| IV. | Analysis of the Data | 5 |
| RESULTS | | 6 |
| I. | The Mathematics Curriculum | 6 |
| A. | Match with Students' Cognitive Development | 6 |
| B. | Meeting Students' Diverse Characteristics and Needs | 7 |
| C. | Balance and Sequence of Content, Skills, and Learning Outcomes | 9 |
| II. | The Student--Mathematics Performance, Attitudes, and Later Success | 13 |
| A. | Perceptions About Their Math Education and Attitudes Toward Mathematics | 13 |
| B. | Graduates' Use of Mathematics in Further Study and Employment | 15 |
| C. | Career Education Related to Mathematics | 16 |
| D. | Knowledge of Mathematics Content and Skills | 18 |
| E. | Success of Students Who Enroll in Algebra I in Grade Seven | 21 |
| F. | Characteristics of Students by Math Elective | 29 |
| G. | Awarding Applied Math Credits to Vocational Students | 35 |
| H. | Additional Comments Made by Students | 38 |
| III. | Mathematics Instruction | 41 |
| A. | Implementation of the Curriculum | 41 |
| B. | Profile of Mathematics Teachers | 46 |
| C. | Staff Development Interests and Needs | 50 |
| D. | Strategies and Information Used in Instruction | 52 |
| E. | Use of Microcomputers in Mathematics | 59 |
| F. | Class Sizes and Teaching Loads | 60 |
| G. | Use of Mathematics Curriculum Materials | 61 |
| H. | Assistance Requested to Increase the Effectiveness of Math Instruction | 65 |
| I. | Additional Comments Made by the School Staff | 66 |
| IV. | The Responses of the Mathematics Consultants | 69 |
| A. | Mathematics Curriculum | 69 |
| B. | Selection for the Gifted/Talented Mathematics Program | 71 |
| C. | Correspondence Between Tests and the Mathematics Curriculum | 71 |
| D. | Staff Development | 71 |

| | | Page |
|---|---|---|
| SUMMARY, OBSERVATIONS, AND RECOMMENDATIONS | | 73 |
| I. | Summary and Observations | 73 |
| | A. The Mathematics Curriculum | 73 |
| | B. The Student--Performance, Attitudes, and Later Success | 74 |
| | C. Mathematics Instruction | 75 |
| II. | Recommendations | 76 |
| | A. Consultants | 76 |
| | B. School Staff | 77 |
| | C. Students | 78 |
| III. | Discussion of the Model and Concluding Observations | 78 |
| APPENDICES | | 80 |
| A | Questions asked of and Curriculum Materials Reviewed by Consultants | 80 |
| B | Survey of Students | 83 |
| C | Survey of Students with Algebra I in Grade 7 | 87 |
| D | Survey of Former Students | 89 |
| E | Survey of Principals and Other Administrators | 91 |
| F | Survey of Guidance Counselors | 97 |
| G | Survey of Elementary Teachers | 102 |
| H | Survey of Middle/Junior High School Teachers | 110 |
| I | Survey of Senior High School Teachers | 118 |

# MATHEMATICS PROGRAM EVALUATION

## FINAL REPORT

Submitted by the Office of Research
Timothy R. Dangel, Coordinator

## INTRODUCTION

## I. THE MODEL AND PROCESS FOR EVALUATING CURRICULUM PROGRAMS

### A. THE EVALUATION MODEL AND ITS PREVIOUS USES

A model designed to evaluate curriculum programs was presented to the Board of Education in November 1980. This model provided for the evaluation of three phases of a program: the curriculum; implementation of the curriculum; and students' performance, attitudes, and later success. The model provided a comprehensive view of a program which went beyond the scope of evaluation models previously used. Within each phase of the model (the curriculum, instruction, and student data), a series of broad research questions were generated to guide the evaluation design. The model has been used previously to evaluate the Science and English Language Arts programs. Each evaluation has resulted in a set of specific program recommendations and significant program changes which are ongoing and are monitored annually.

### B. THE REQUEST TO EVALUATE THE MATHEMATICS PROGRAM

During the 1983-84 school year, the Office of Research received a request from the Superintendent of Schools and the School Directors to evaluate the Anne Arundel County School's Mathematics Program using the evaluation model. Evaluation questions were submitted and compiled and the evaluation was designed in the fall of 1983. The Board of Education received the evaluation questions and research design on December 7, 1983. The evaluation design was implemented and the data were gathered during 1984. All phases of this evaluation were reviewed monthly by the School and Program Evaluation Committee.

## II. THE BROAD RESEARCH QUESTIONS

The following questions, submitted by the School Directors, Coordinator of Mathematics, members of the School and Program Evaluation Committee, and mathematics department chairpersons and teachers, were used as the primary guidelines for developing the evaluation design. The questions were answered by collecting information from seven sources: consultants, a survey of current students, survey of former students, survey of school staff, survey of students enrolled in Algebra I as seventh graders, high school achievement data in mathematics, and other data previously collected which was available within the school system.

### A. THE MATHEMATICS CURRICULUM

Does the mathematics curriculum reflect current trends in curriculum development and current research in learning and instruction?

Does the mathematics curriculum match students' cognitive development at each grade and age level?

Does the mathematics curriculum meet students' diverse needs and characteristics?

Are the mathematics content, skills, and learning outcomes appropriately sequenced and balanced?

Is the amount of time devoted to mathematics instruction, kindergarten through grade twelve, sufficient and balanced with other content areas?

What is the best organization for high school Unified Mathematics and other elective courses?

Are the inservice opportunities available to teachers sufficient to insure that the mathematics curriculum is implemented to the fullest?

### B. THE STUDENT -- MATHEMATICS PERFORMANCE, ATTITUDES, AND LATER SUCCESS

How do students currently enrolled in and graduates of the Anne Arundel County Public Schools evaluate their mathematics education?

What are current students' and graduates' attitudes toward mathematics?

How well prepared in mathematics are graduates for their employment or further study in mathematics?

Are students aware of the mathematics requirements for employment and career opportunities?

How well are students enrolled in the public schools succeeding in mathematics?

How successful are students who complete Algebra I in grade seven? How successful are they in later mathematics courses?

What are the characteristics (achievement, ability, race, sex) of students in each of the mathematics elective courses?

What are the students'/staff's perceptions about awarding vocational trade students one applied mathematics credit upon completing two years of a trade?

C. MATHEMATICS INSTRUCTION

To what degree is the Anne Arundel County Mathematics Curriculum being implemented at the classroom level kindergarten through grade twelve?

What are mathematics teachers' preparations for and experiences in teaching?

What are mathematics teachers' staff development interests and needs?

What instructional strategies, organizations, and student data do teachers use to teach mathematics in kindergarten through grade twelve?

How are microcomputers being used in mathematics in elementary and secondary schools?

What are the ranges in teachers' class sizes and teaching loads?

Are the mathematics curriculum materials complete and clear? How are teachers using them?

What types of assistance are needed to help increase the effectiveness of mathematics instruction?

## III. THE EVALUATION PROCEDURES

The broad research questions were the basis for generating a set of more specific questions to be asked of consultants, staff, and students. The specific methods for gathering each type of information are presented below:

A. CONSULTANTS

One of the major components of the evaluation was the use of outside specialists as consultants to examine the Mathematics Curriculum. Potential consultants were identified and recommended by the National and Maryland Councils for Teachers of Mathematics and by the staff. From the names submitted five consultants in mathematics were selected to represent a breadth of expertise in mathematics education, classroom experience, and mathematics curricula at the local, state, and national levels. The five consultants were:

Mrs. Audrey Buffington, Wayland (MA) High School
Dr. James Fey, University of Maryland
Dr. Thomas Rowan, Montgomery County Public Schools
Dr. Leon Sagan, Anne Arundel Community College
Dr. Max Sobel, Montclair (NJ) State College

Each of the consultants received a list of questions to address and a set of grades kindergarten through twelve curriculum materials to examine in responding to the questions (Attachment A, page 80).

Following their examination of the materials, the consultants independently addressed the questions in written reports. On April 13, 1984, the consultants met in Annapolis for one day. At that time, following a presentation and discussion of the five reports, Mrs. Buffington wrote one final summary report synthesizing from each of the individual reports the strengths of, weaknesses of, and recommendations for the mathematics curriculum. The summary evaluation report is found in total as Section IV of the Results and addresses many of the questions raised about the Mathematics Curriculum.

B. CURRENT AND FORMER STUDENTS

Current Students. A survey for students currently enrolled in the Anne Arundel County Public Schools was developed to reflect the research questions asked about mathematics instruction and students'

attitudes toward, knowledge of, and later success in mathematics. The survey was mailed to a sample of 1598 students enrolled in grades nine through twelve during the 1983-84 school year. Surveys were returned by 548 students. The composition of the sample of current students is as follows:

| Sex | | Grade | |
|---|---|---|---|
| Males | 229 | 9 | 164 |
| Females | 295 | 10 | 141 |
| | | 11 | 102 |
| | | 12 | 84 |

| Program | |
|---|---|
| Academic | 251 |
| Business | 54 |
| Trade | 38 |
| General | 115 |
| Don't Know | 38 |

A copy of the Survey of Current Students is found as Appendix B (page 83). The results from this survey are reported in the Results section of this report.

Students Who Enrolled in Algebra I in Grade Seven. Students who had enrolled in Algebra I in grade seven during the 1980-81 and 1982-83 school years were identified; all 585 students identified were mailed a survey which dealt with questions related to their experiences in Algebra I as seventh grade students. Surveys were returned by 330 students. The composition of the sample is as follows:

| Sex | | Grade | |
|---|---|---|---|
| Males | 145 | 9 | 202 |
| Females | 178 | 10 | 85 |
| | | 11 | 2 |

A copy of the Survey of Students with Algebra I in Grade 7 is found as Appendix C (page 87). The results from this survey are reported in the Results section of this report.

Former Students. A sample of the cumulative records of Anne Arundel County Public Schools' graduates between 1978 and 1983 were examined. The sample was based upon the size of each graduating class so as to be representative of graduates over a five year period. From each of the 1355 records examined the graduate's name, address, graduation year, sex, race, high school program (if known), specific mathematics courses taken, final course grades, mathematics credits earned, and ability and achievement test scores were recorded, where available. The data from 1280 students who graduated and who were enrolled at least three years in high school in Anne Arundel County were recorded, keypunched, and analyzed. The specific analyses of this information are presented in greater detail under Other Data Available: Cumulative Records of the Procedures. Surveys were sent to 1355 former students and were returned by 311. The composition of the sample is as follows:

| Sex | |
|---|---|
| Males | 118 |
| Females | 173 |

| Employment/Educational Status | |
|---|---|
| Employed full-time | 70 |
| Employed part-time | 18 |
| Enrolled in school full-time | 19 |
| Enrolled in school and working | 103 |
| Homemaker | 11 |
| Unemployed | 8 |

| Types of Schools Attended | |
|---|---|
| Trade, Technical or Business | 11 |
| Junior Community College | 40 |
| Four Year College or University | 69 |
| Graduate or Professional | 6 |

A copy of the Survey of Former Students is found as Appendix D (page 89). The results from this survey are reported in the Results section of this report.

## C. SCHOOL ADMINISTRATORS, COUNSELORS, AND TEACHERS

Evaluation questions were identified to be asked of school administrators (principals, assistant principals, and administrative interns), guidance counselors, and mathematics teachers. The questions were so diverse and specific to both types of staff and grade level that it was not possible to construct one survey for all staff without confusion. Separate surveys were constructed and distributed to all school administrators, guidance counselors, and elementary, middle/junior, and senior high school mathematics teachers. The survey questions addressed issues related to the mathematics curriculum, students, and instruction. The results of each survey are found in the Results section of this report. The composition of each of the samples returning surveys is reported below.

Principals and other School Administrators. Surveys were sent to all 206 school administrators, 110 were returned. The composition of the sample is as follows:

| School Principal | | Assistant Principal or Administrative Intern | |
|---|---|---|---|
| Elementary | 54 | Elementary | 9 |
| Middle School | 6 | Middle School | 8 |
| Junior High | 5 | Junior High | 9 |
| Senior High | 5 | Senior High | 14 |

A copy of the Survey of Principals and Other Administrators is found as Appendix E (page 91).

Guidance Counselors. Surveys were sent to all 120 guidance counselors, 63 were returned. The composition of the surveys returned by counselors is as follows:

| | |
|---|---|
| Elementary | 6 |
| Middle School | 14 |
| Junior High | 16 |
| Senior High | 27 |

A copy of the Survey of Guidance Counselors is found as Appendix F (page 97).

Elementary Teachers. All elementary teachers received a survey; those teaching mathematics were asked to complete and return one. Six hundred eighty elementary teachers returned a survey. A copy of the Survey of Elementary Teachers is found as Appendix G (page 102).

Middle/Junior High Teachers. Surveys were sent to all 140 mathematics teachers in middle/junior high schools, 114 were returned. Surveys were completed by 17 mathematics department chairpersons and 93 mathematics teachers. A copy of the Survey of Middle/Junior High School Teachers is found as Appendix H (page 110).

Senior High School Teachers. Surveys were sent to all 120 senior high school mathematics teachers, 93 were returned. Surveys were returned by 15 mathematics department chairpersons and 77 mathematics teachers. A copy of the Survey of Senior High School Teachers is found as Appendix I (page 118).

## D. ACHIEVEMENT TEST SCORES

Norm referenced, standardized achievement test scores are available countywide for all students in grades three, five, and eight and for college-bound senior high school students. However, they are not available for a representative sample of all senior high school students. Therefore, the evaluation design provided for the administration of a norm referenced, standardized achievement test to a representative sample of eleventh grade students. Eleventh grade was selected because most students had earned their required two mathematics credits by then and it allowed for an examination to be made of the mathematics experiences of non-trade students with the same level of math achievement as vocational students who had earned one of their required mathematics credits as an applied math credit.

The test administered was the eleventh grade level of the California Achievement Test (McGraw-Hill, 1978). This test has the same focus and test objectives consistent with the tests currently administered to students in grades three, five, and eight for comparison. The test objectives also match the County Mathematics Scope and Sequence.

It was not necessary to test every eleventh grade student in order to obtain an accurate measure of eleventh grade math achievement. Thirty eleventh grade students were randomly selected in each senior high school. These students were administered the test between April 16 and May 18, 1984. The test results for 276 students were returned for scoring. A similar sample was selected for trade students at the vocational-technical centers, where 91 students were tested.

## E. OTHER AVAILABLE DATA

In addition to collecting the types of information described above, data pertinent to the evaluation questions which had been collected prior to the evaluation was identified and assembled. This information is included in the Results section and consists of:

Cumulative Records. Cumulative records were examined for 1280 students who graduated from the Anne Arundel County Public Schools between 1978 and 1983. The sample was selected to be representative of both school enrollment and graduation years. The composition of this sample was:

| Sex | | Program | |
|---|---|---|---|
| Male | 612 (48%) | Academic | 287 (23%) |
| Female | 657 (52%) | Business | 296 (24%) |
| | | Vocational | 233 (19%) |
| | | General | 429 (35%) |

Test Results. Mathematics test results were complied for the following tests: Iowa Tests of Basic Skills (1974-1980, grades 3, 5, 7, 9), California Achievement Test (1980 to present, grades 3, 5, and 8); Maryland Functional Mathematics Test (1982-1984, grades 7 and 9), and Scholastic Aptitude Test (1975-1984, college-bound seniors).

Scheduling/Grade Reporting Data. Enrollment numbers for each elective mathematics course by grade for fall 1984 and the distribution of final course grades for each secondary mathematics course or elective for the 1983-84 school year.

Credit by Examination Data. The number and percentage of students taking examinations in Algebra I, Algebra II, and Fused Geometry for credit, and the number and percentage of students earning credit for courses completed prior to grade nine.

Personnel Office Data. The number of full and part-time mathematics teachers for the 1983-84 and 1984-85 school years, the average age and years of experience of teachers, the certification of secondary teachers teaching mathematics, and the numbers of mathematics teachers retiring or resigning were made available by the Personnel Office for this evaluation.

Staff Development Office. The Staff Development Office provided a count of the numbers of teachers participating in staff development workshops, the Math Certification Program, and the Certification Upgrade Program.

Teachers' Schedule Cards. Teachers' schedule cards were made available by the Mathematics Office to determine the average and range of class sizes in secondary schools, the number of classes mathematics teachers are teaching, and the number of different courses secondary mathematics teachers are teaching daily.

Mathematics Office. The Mathematics Office made available a count of the number of teachers participating in non-credit mathematics workshops.

# IV. ANALYSIS OF THE DATA

The responses of staff and students on the various surveys and students' test responses were coded onto machine scannable forms; the data from cumulative records were keypunched. Survey, cumulative records and test data were analyzed by the various statistical programs available through data processing. These analyses produced the frequency and percentage of responses to survey items and provided for the comparison of the responses among various groups, such as current and former students. These results, a summary of all comments made to open-ended survey items, and the other data previously described are presented in the next section of this report.

## RESULTS

Source of Data

The results section of this evaluation report is divided into four sections: The Mathematics Curriculum; Students' Performance in, Attitudes toward, and Later Success in Mathematics; Mathematics Instruction; and The Consultants' Report. Within each of the sections the results of the consultants, surveys, tests, and other data are organized by the research questions which guided this evaluation. Each research question will be followed by a narrative and/or table of the results, patterns observed in the data, and comments. To the right of each narrative will be a series of codes which relate each finding to the source of the data. The codes are:

| | | | |
|---|---|---|---|
| CS | - Survey of Current Students | GC | - Survey of Guidance Counselors |
| FS | - Survey of Former Students | SGRD | - Scheduling/Grade Report Data |
| A17 | - Survey of Students who Took Algebra I in grade seven | CBE | - Credit by Examination Data |
| | | CR | - Cumulative Records |
| ET | - Survey of Elementary Teachers | TS | - Test Scores |
| MJT | - Survey of Middle/Junior High Math Teachers | POD | - Personnel Office Data |
| | | SDO | - Staff Development Office Data |
| SHT | - Survey of Senior High School Math Teachers | TSC | - Teacher's Schedule Cards |
| | | MO | - Mathematics Office Data |
| PA | - Survey of Principals and Other School Administrators | | |

In addition, a number following a code for a survey refers to the specific item on the survey.

**Note: All data in tables represent the percentage of respondents choosing each answer unless otherwise noted or unless the numerals are enclosed in parentheses. Numbers enclosed in parentheses indicate the number of respondents making a specific comment or response.**

### I. THE MATHEMATICS CURRICULUM

INTRODUCTION: The questions in this section of the evaluation report address a series of issues about the Mathematics Curriculum such as its match with students' cognitive development, the degree to which it meets the diverse characteristics of students, and the balance and sequence of content, skills and learning outcomes.

The data related to each issue are presented and discussed separately along with the sources of data, a summary of written comments, and major trends evident in the data. A summary of this data related to the mathematics curriculum is included at the end of this section.

A. DOES THE MATHEMATICS CURRICULUM MATCH STUDENTS' COGNITIVE DEVELOPMENT AT EACH GRADE AND AGE LEVEL?

GC 3
ET 6
MJT 6
SHT 6

| | GUIDANCE COUNSELORS | TEACHERS | | |
|---|---|---|---|---|
| | | ELEM | M/JHS | SHS |
| Yes | 65 | 87 | 75 | 77 |
| No | 21 | 11 | 13 | 11 |
| I don't know | 11 | 3 | 12 | 12 |

Of the staff members who believe that the mathematics curriculum does not match students' cognitive development, there were 43 specific comments or reasons given. The major reasons given were:

> The curriculum is too advanced developmentally for average and low ability students; and it is not challenging enough for the brightest students (with the exception of gifted/talented students in grades seven and eight where six teachers/counselors believe that students are not developmentally ready for Algebra I in grade seven and/or Geometry in grade eight).

These data suggest that two-thirds of the counselors and more than three-fourths of teachers report that the Mathematics Curriculum matches students' cognitive development at each grade and age level.

Note: Determination of differences in response to items within a survey and among separate surveys is based on the recommended allowance for sampling error of a percentage. In Burger, W. and Duckett, W. Polling Attitudes of Community on Education. Bloomington, IN: Phi Delta Kappa, 1980.

## B. DOES THE CURRICULUM MEET THE DIVERSE CHARACTERISTICS AND NEEDS OF STUDENTS?

GC 4,5
ET 7
MJT 7
SHT 7,8
PA 28

### 1. Meeting the diverse characteristics of students

Do skills and content in the curriculum meet students' diverse needs?

| | GUIDE COUNS | PRIN | TEACHERS ELEM | M/JHS | SHS |
|---|---|---|---|---|---|
| Yes | 73 | * | 87 | 83 | 87 |
| No | 19 | | 11 | 13 | 10 |
| I don't know | 7 | | 2 | 5 | 3 |

Do the number of courses in grades 9 - 12 meet students' diverse needs?

| | | | | | |
|---|---|---|---|---|---|
| Yes | 61 | 74 | * | * | 74 |
| No | 18 | 22 | | | 25 |
| I don't know | 21 | 4 | | | 1 |

* Question was not included on surveys for these staff members.

Staff who reported that the skills and content in the curriculum do not meet the diverse needs of students gave 27 comments with their answers. The major reasons given were:

The skills and content will meet the diverse needs of students only when they can be grouped to meet individual students' needs (6);
The skills and content do not meet the needs of slower students (e.g., a slower pace and more consumer/practical math) (5);
The skills and content are not challenging enough for the highly able students (5);
The remaining comments dealt with concerns about the influence of the California Achievement Test on the math curriculum, specific needs of special education, and general statements about the scope of the curriculum.

Staff who reported the number of courses offered in grades nine through twelve do not meet the diverse needs of students made ten comments with their answers. Nine of the ten comments dealt with the fact that too few mathematics courses were offered in grades nine through twelve. The comments also suggested that additional courses are needed to fill the gap between Algebra I and general math, for remedial work at higher grade levels, and that more mathematics staff are needed to decrease class size and enable more courses to be offered to students.

These results suggest that:

a. About three-fourths of the counselors and more than eighty percent of the teachers report that the skills and content in the mathematics curriculum meet the diverse needs and interests of students.

b. About sixty percent of the counselors and three-fourths of the principals and senior high school teachers report that the number of courses is adequate to meet the diverse needs of students in grades nine through twelve.

PA 7-9,34,47
GC 9-11,28
ET 63-65
MJT 58-60
SHT 51-53,102

### 2. Mathematics for gifted/talented students

a. How are students selected for Gifted/Talented, (G/T) Program Offerings?

| | PRIN | GUIDE COUNS | TEACHERS ELEM | M/JHS | SHS |
|---|---|---|---|---|---|
| Students are selected and identified separately in each subject | 88 | 97 | 63 | 84 | 81 |
| Students are selected globally for all G/T programs offered in the school | 8 | 3 | 9 | 6 | 11 |
| Other | 4 | 0 | 5 | 10 | 8 |

b. What information is used to identify gifted/talented students?

(361 responses were given; those made by five or more respondents are listed below in order of frequency)
Achievement and ability test scores (112);
Teacher/counselor recommendation (93);
The Gifted/Talented screening formula (85);
Classroom performance/grades (58);
Students' interests, maturity and work habits (9).

c. How are students selected for Advanced Placement (AP) Calculus?

(105 responses were given; they are listed below in order of frequency)
Teacher/counselor recommendation (38);
Performance/grades in previous courses (32);
Meeting county requirements/prerequisites (26);
Students' interests and motivation (5).

d. Does the math program for gifted/talented students differ substantially from the regular math program in this school?

| | PRIN | GUIDE COUNS | TEACHERS ELEM | M/JHS |
|---|---|---|---|---|
| Yes | 71 | 72 | 39 | 71 |
| No | 26 | 16 | 27 | 13 |

Respondents who answered No made 21 comments about why the math program for gifted/talented students does not differ substantially from the regular math program in their school. Their reasons fell into five basic categories: non-gifted students are recommended for gifted programs (especially Algebra I students in grade seven); the programs are the same, gifted students are just accelerated; teachers lack the expertise and time to implement a separate math program for gifted/talented students; limited staffing prevents implementation of a math gifted/talented program; and with a non-graded organization and continuous progress curriculum, a separate gifted/talented program is not necessary.

e. Do the selection criteria for the gifted/talented program seem to correlate with high mathematics aptitudes?

| | TEACHERS ELEM | M/JHS | SHS |
|---|---|---|---|
| Yes | 52 | 62 | 72 |
| No | 7 | 28 | 7 |
| I don't know | 41 | 10 | 21 |

Teachers who indicated that the selection criteria do not seem to correlate with high mathematics aptitudes made 17 comments about the lack of correlation. The reasons fall into four basic categories: some students identified as gifted/talented have difficulty with the mathematics; the selection standards for gifted/talented programs are too low; the selection criteria are vague, ambiguous, and/or subjective; and some mathematically gifted students are poor readers.

f. What kinds of courses do you counsel highly able mathematics students to schedule?

| | PRIN | GUIDE COUNS | SHS |
|---|---|---|---|
| AP Calculus | 95 | 85 | 65 |
| Other math electives | 58 | 70 | 29 |

The other math electives listed (in order of frequency) are:

Algebra III
Analytic Geometry
Probability and Statistics
Computer Math
Algebra I
Fused Geometry
Trigonometry
Algebra II
Advanced Computer Math

These data suggest that:

(1). Students are usually selected and identified separately for gifted/talented programs in each subject. According to teachers' responses, the separate identification by program is more likely to occur in secondary schools then in elementary.

(2). The kinds of information the staff uses to select students for gifted/talented programs are (in order of frequency) achievement and ability levels, teacher/counselor recommendation, the gifted/talented screening algorithm, and classroom performance/grades.

(3). Teachers and counselors responded that teacher/counselor recommendation, a student's performance in previous courses, and meeting the County course requirements and prerequisites are the three major methods for selecting students for Advanced Placement Calculus.

(4). The Gifted/Talented Program differs substantially from the regular mathematics program in middle and junior high schools and in senior high schools where mathematics electives are available to all students. Responses are less clear in elementary schools where the teachers were almost evenly divided on the issue.

(5). While most of the teachers responded that the selection criteria for the gifted/talented program seems to correlate with high math aptitudes, the correlation appears to increase from elementary to senior high school. Teachers who indicate that the correlation is low list low or vague selection criteria as the primary reason.

(6). Most highly able senior high school mathematics students are counseled to enroll in Advanced Placement Calculus. Other courses they are counseled to scheduled are Algebra III, Analytic Geometry, Probability and Statistics, and Computer Math.

(7). While teachers tend to encourage gifted/talented students to enroll in AP Calculus, guidance counselors' responses indicate that they encourage students to enroll in a wider variety of high level academic mathematics electives.

C. ARE THE MATHEMATICS CONTENT, SKILLS, AND LEARNING OUTCOMES SEQUENCED AND BALANCED?

1. Reinforcement of skills and content

ET 10
MJT 10
SHT 11

Are the skills and content which teachers introduce reinforced in later grades/courses?

| | TEACHERS ELEM | M/JHS | SHS |
|---|---|---|---|
| Yes | 89 | 89 | 89 |
| No | 1 | 2 | 6 |
| I don't know | 10 | 9 | 6 |

2. Unnecessary duplication in mathematics content

PA 4
GC 6
ET 9
MJT 9
SHT 10

Is there any unnecessary duplication in the mathematics content from grade to grade or course to course?

| | PRIN | GUIDE COUNS | TEACHERS ELEM | TEACHERS M/JHS | TEACHERS SHS |
|---|---|---|---|---|---|
| Yes | 15 | 16 | 9 | 21 | 25 |
| No | 73 | 49 | 62 | 69 | 63 |
| I don't know | 12 | 34 | 27 | 11 | 12 |

Staff members who responded that there is unnecessary duplication in math content made 38 responses where the duplication is occurring. Most of these comments fell into two categories: duplication in Unified Mathematics courses and too much review and repetition. The reminder of the comments were single comments that identified specific courses and grade levels where there is duplication of mathematics content.

3. Topics omitted from the curriculum

ET 11
MJT 11
SHT 12

Are there topics/skills omitted from earlier grades/courses which students need to know in the grades/courses you teach?

| | TEACHERS ELEM | TEACHERS M/JHS | TEACHERS SHS |
|---|---|---|---|
| Yes | 16 | 43 | 36 |
| No | 74 | 49 | 55 |
| I don't know | 11 | 8 | 9 |

Respondents who answered that there were topics/skills omitted listed the following in order of frequency:

Fractions
Measurement
Time
Basic operations and number facts
Percent
Decimals
Radicals

4. Increasing credits in mathematics to 3.0

PA 19
GC 25
SHT 94

What is your opinion about increasing the required mathematics credits for graduation to three?

| | PRIN | GUIDE COUNS | SHS TCHR |
|---|---|---|---|
| Three credits are too low. | 15 | 13 | 10 |
| Three credits are about right. | 80 | 79 | 67 |
| Three credits are too high. | 5 | 8 | 23 |

5. Does the curriculum give appropriate emphasis to specific content areas

ET 14-20
MJT 14-20

| | ELEMENTARY TEACHERS AMOUNT OF EMPHASIS | | | MIDDLE/JHS TEACHERS AMOUNT OF EMPHASIS | | |
|---|---|---|---|---|---|---|
| Unified Math Strands | Too Much | About Right | Too Little | Too Much | About Right | Too Little |
| Analysis of number and numeration systems | 5 | 90 | 5 | 2 | 91 | 7 |
| Numeric and algebraic operations | 4 | 83 | 13 | 2 | 88 | 10 |
| Graphic operations | 4 | 80 | 20 | 6 | 78 | 16 |

| Unified Math Strands | ELEMENTARY TEACHERS AMOUNT OF EMPHASIS Too Much | About Right | Too Little | MIDDLE/JHS TEACHERS (Continued) AMOUNT OF EMPHASIS Too Much | About Right | Too Little |
|---|---|---|---|---|---|---|
| Geometry | 5 | 82 | 13 | 10 | 71 | 19 |
| Measurement and probability | 7 | 75 | 19 | 12 | 58 | 31 |
| Sets and logic | 9 | 74 | 17 | 13 | 58 | 29 |
| Problem solving | 2 | 66 | 32 | 4 | 52 | 44 |

These data suggest that:

a. While two-thirds of the teachers responded that there is no unnecessary duplication in the mathematics curriculum from grade-to-grade/course-to course, at least one out of five secondary teachers believe that unnecessary duplication does exist in the curriculum. Written comments suggest that most of the duplication is in Unified Mathematics and is due to too much review and repetition.

b. Three-fourths of the elementary teachers of mathematics responded that there are no topics/skills omitted from the math curriculum at grade levels lower than the one(s) they teach. More than one-third of the secondary teachers report that topics/skills are omitted in earlier grades/courses which students need to know in the grades/courses they teach. Specific topics/skill areas are listed.

c. Two-thirds of senior high school teachers and about 80 percent of school administrators and guidance counselors believe that requiring three mathematics credits for high school graduation is a good decision. If a teacher did not respond that the increase was about the right number of credits, he/she answered that the three credits were too high rather than too low by a two-to-one margin.

d. Most teachers report that the Unified Mathematics curriculum gives an appropriate emphasis to the seven strands of mathematics content. Elementary teachers report, however, that more emphasis is needed in graphic operations; middle/junior high school teachers perceive more emphasis is necessary in geometry and sets and logic. All teachers believe more emphasis is necessary in measurement and probability and problem solving.

SUMMARY: The major findings related to the mathematics curriculum are summarized below. For more detail about any of the summarized findings, the reader will wish to consult the individual evaluation questions and related data presented and discussed in greater detail in the body of this section of the evaluation report.

1. The responses of the majority of guidance counselors and teachers indicate that the staff believes that the Anne Arundel County Mathematics Curriculum matches students' cognitive development at each grade/age level as well as the diverse needs and interests of students.

2. In most schools students are selected to participate in gifted/talented mathematics programs separately from their selection to participate in other content area gifted/talented programs, although separate identification by program is more likely to occur in secondary schools than in elementary. A variety of types of information are gathered and used in selecting students, they include: mathematics achievement and quantitative ability scores, teacher/counselors recommendation, the Gifted/Talented Program screening algorithm, classroom performance/grades, and course requirements and prerequisites.

3. The mathematics Gifted/Talented Program in secondary schools differs substantially from the regular mathematics program. The differences in the elementary schools are not so clear.

4. Most teachers report that the selection criteria for the gifted/talented mathematics program seem to correlate with high math aptitudes.

5. Gifted/talented students in senior high schools tend to enroll in and be encouraged to enroll in Advanced Placement Calculus, although other courses such as Algebra III, Analytic Geometry, Probability and Statistics, and Computer Mathematics also make up their mathematics program.

6. Most teachers do not believe that there is unnecessary duplication in the mathematics curriculum. Secondary teachers identified some specific areas where topics are omitted, these are listed in the body of this section.

7. The requirement to increase the number of mathematics credits needed for graduation from two to three is viewed as the right decision by principals, teachers and guidance counselors.

8. Although the Unified Mathematics Curriculum gives an appropriate emphasis on strands of mathematics content according to most teachers, some teachers believe that greater emphasis is necessary in graphic operations, geometry, sets and logic, measurement and probability, and problem solving.

Note: Additional questions related to the Mathematics Curriculum were addressed by the consultants. Their discussion of the mathematics curriculum can be found in Section IV of this report, "Consultants' Reports."

## II. THE STUDENT—MATHEMATICS PERFORMANCE, ATTITUDES, AND LATER SUCCESS

INTRODUCTION. The questions and data in this section of the evaluation report address a series of issues about students' knowledge of mathematics concepts, performance of mathematics skills, attitudes about mathematics, and success in mathematics following high school graduation. Specific areas in which data have been gathered include students' evaluation of their mathematics education, preparation in mathematics for employment or post secondary education, knowledge of career and employment opportunities requiring a background in mathematics, the mathematics achievement of current students, the success of students who enroll in Algebra I in grade seven, and the characteristics of students who enroll in each of the secondary mathematics electives as well as those who earn an applied mathematics credit by completing two years of a trade in the vocational-technical centers.

The data related to each issue is presented and discussed separately along with the sources of the data, a summary of the written comments, and major trends evident in the data. A summary of these data related to the mathematics performance, attitudes, and later success of students is included at the end of this section of the evaluation report.

### A. WHAT DO STUDENTS CURRENTLY IN OR GRADUATES OF THE ANNE ARUNDEL COUNTY PUBLIC SCHOOLS THINK ABOUT THEIR PREPARATION IN MATHEMATICS? WHAT ARE THE STUDENTS' ATTITUDES TOWARD MATHEMATICS?

Source of Data: CS 3, 4; FS 8, 9

1. Students' satisfaction with their mathematics education:

| | Current Students | Former Students |
|---|---|---|
| Mathematics education received | | |
| Satisfied | 62 | 57 |
| Dissatisfied | 14 | 17 |
| Number and variety of courses | | |
| Satisfied | 70 | 66 |
| Dissatisfied | 7 | 7 |

Students who are dissatisfied with their mathematics education and the variety of courses offered gave 102 comments about their dissatisfaction. They are summarized below. The reasons current students give for dissatisfaction with their mathematics education include: poor teaching, teachers not taking enough time to explain, and teachers' teaching methods. Former students listed unclear teaching, being unprepared for college math, and not enough basics as the primary reasons for their dissatisfaction.

The reasons current and former students give for dissatisfaction with the number and variety of mathematics courses include: some courses were not available to choose from at their school, too few courses offered, and not enough diversity in courses or advanced courses were available.

These results suggest that:

a. Approximately sixty percent of the students express satisfaction with the mathematics education they received or are receiving and with the number and variety of mathematics courses offered.

b. Current and former students do not differ in their satisfaction with the mathematics education and variety and number of mathematics courses available.

c. Former students are slightly more dissatisfied than current students with the mathematics education they received.

d. Both current and former students express more satisfaction with the number and variety of courses offered than with the mathematics education they received or are receiving.

2. Students' assessment of the mathematics program and teaching:

CS 5, 6
FS 10, 11

What grade would you give to the mathematics:

| | Current Students | Former Students |
|---|---|---|
| Program | | |
| A-B | 70 | 60 |
| C | 24 | 32 |
| D-E | 6 | 7 |
| Teaching | | |
| A-B | 54 | 57 |
| C | 30 | 29 |
| D-E | 16 | 14 |

These results suggest that:

a. More than half of the students gave the mathematics program and teaching an A or B.

b. Current and former students do not differ in the grades they gave to the mathematics program and teaching.

c. More current students gave an A or B to the mathematics program than to teaching; former students did not differ in the grades they gave to the mathematics program and teaching.

3. Students attitudes about mathematics

CS 38-47
FS 17-19
GC 31

| Current students | Yes | No |
|---|---|---|
| Do you like mathematics? | 75 | 19 |
| Are you good at mathematics? | 72 | 20 |
| Are you taking mathematics only because you have to? | 30 | 68 |
| Would you like to take more math? | 58 | 32 |
| Do you usually understand what your teacher is talking about in math? | 78 | 18 |
| Would you like a job that lets you use math? | 52 | 27 |
| Is math more for boys than for girls? | 6 | 71 |
| Is math useful to solve everyday problems? | 75 | 15 |
| Do you think math will be useful to you in the future? | 90 | 5 |
| Do you think you can get along well in everyday life without using math? | 10 | 78 |
| It is important to know arithmetic in order to get a good job? | 88 | 7 |
| It is important to know mathematics such as algebra and geometry in order to get a good job? | 51 | 15 |

| Former Students | Agree | Disagree |
|---|---|---|
| High school math classes were useful | 83 | 5 |
| Much of what I learned in math is useful to me everyday | 64 | 16 |
| Much of what I learned in math will be useful in future | 71 | 12 |

Guidance counselors were asked to respond to a question about student's attitudes about mathematics courses compared to other courses. Of the 50 comments made by counselors those given five or more times are listed below in order of frequency (which range from 13 to 6):

The math program is viewed by students as a good one and students value math as a functional part of their personal, future, and professional lives;
Students' opinions vary and depend on the individual students as well as the individual teacher (teachers appear to have more influence on attitudes than courses and course content);
Students view math courses and math concepts to be more difficult than other courses (although this may be more true of students with a lack of interest in math and poor skills than of students generally);
Math courses are about the same as other courses;

These results suggest that:

a. The majority of students currently in the schools like mathematics; believe that they are good in mathematics; do not take math only because it's required; would like to take more math; usually understand what the teacher is presenting; would like a job that requires the use of math; and believe that math is not more for boys than for girls, is useful to solve everyday problems, will be useful in the future, that they can not get along well in everyday life without mathematics, and that it is important to know arithmetic and mathematics in order to get a good job.

b. The majority of graduates report that high school mathematics classes were useful and that what they learned is currently useful and will be useful in the future.

c. Both current and former students appear to believe that mathematics will be more useful to them in the future than it is in everyday life.

d. Guidance counselors responses echo those of students and indicate students' attitudes toward math are largely individual and may be more influenced by a teacher than by math content.

B. HOW WELL PREPARED IN MATHEMATICS ARE THE ANNE ARUNDEL COUNTY PUBLIC SCHOOL'S GRADUATES FOR THEIR EMPLOYMENT OR FURTHER STUDY IN MATHEMATICS? HOW ARE THEY USING THE MATHEMATICS SKILLS AND CONCEPTS THEY LEARNED IN HIGH SCHOOL?

1. <u>Math courses graduates wish they could take or had taken:</u> FS 12 CS 35

Do you wish you had taken additional math courses in high school (Former Students) or are there any math courses you would like to take but cannot schedule into your program (Current Students)?

| | Former Students | Current Students |
|---|---|---|
| Yes | 46 | 18 |
| No | 41 | 65 |

The courses former students report that they would have liked to have studied are (in order of frequency out of 145 comments): Calculus, Algebra, Trigonometry, Geometry, Statistics, Algebra II, Accounting, basic math, Business Math, and Algebra III.

2. Mathematics courses taken since graduation and success in them: FS 13, 14

Have you taken any mathematics courses since leaving high school?

| | Former Students |
|---|---|
| Yes | 49 |
| No | 50 |

How well prepared were you?

| | |
|---|---|
| Very well prepared | 21 |
| Prepared | 50 |
| Unprepared | 29 |

Students who report that they were unprepared for mathematics courses taken since high school cite the following reasons for their response (12): lack of basic knowledge, did not take the necessary courses, poor teachers, did not have enough math in high school, and have forgotten a lot of things.

The results suggest that:

a. About one-half of the graduates take at least one mathematics course after high school.

b. More than two-thirds of those students enrolling in a mathematics course since graduation report that the mathematics course they took in the Anne Arundel County Public Schools prepared them for these later courses.

3. Mathematics knowledge and skills required in employment

FS 15, 16

How often does your job require a knowledge of math and math skills?

| | Former Students |
|---|---|
| Frequently | 46 |
| Occasionally | 34 |
| Rarely | 15 |
| Never | 6 |

How well did the mathematics courses you took in high school prepare you for the math knowledge and skills required in your job?

| | |
|---|---|
| Very well prepared | 28 |
| Prepared | 58 |
| Unprepared | 7 |
| Employment required a study of math beyond high school | 7 |

Students who reported being unprepared report the following reasons (11): was unaware of the math courses offered, too much emphasis on algebra and geometry, did not learn enough in high schools, and the teaching was not helpful.

These results suggest that:

a. A knowledge of math and math skills are required at least occasionally in employment for 80 percent of the Anne Arundel County Public School's graduates.

b. Eighty-six percent of the respondents report that the courses they took in high school prepared them for the mathematics that is required in their employment.

C. HOW WELL AWARE ARE STUDENTS OF THE VARIOUS EMPLOYMENT AND CAREER OPPORTUNITIES WHICH REQUIRE A BACKGROUND IN MATHEMATICS? DO STUDENTS KNOW THE MATHEMATICS REQUIREMENTS FOR GRADUATION?

1. Students' awareness of mathematics requirements for employment and career opportunities: CS 7, 8

| | Current Students Grade 9 | 10 | 11 | 12 |
|---|---|---|---|---|
| Percent of students who reported they have decided on the career or employment they wish to pursue after high school | 64 | 72 | 79 | 80 |
| Percent of student who reported that they know the mathematics requirements of their career or employment choice | 47 | 53 | 71 | 73 |

A similar question was asked of staff regarding math requirements for career opportunities. GC 7, 8 MJT 98, 99 SHT 87, 88

| | | Teachers Middle/Junior | Senior | Guidance Counselors |
|---|---|---|---|---|
| Are students aware of the math required for the career opportunities in which they are interested? | Yes | 63 | 77 | 81 |
| | No | 37 | 23 | 19 |
| At what grade do students know these math requirements? | | | | |
| | Prior to Grade 6 | --* | -- | 2 |
| | Grade 6 | 13 | -- | 2 |
| | Grade 7 | 23 | -- | 16 |
| | Grade 8 | 22 | -- | 16 |
| | Grade 9 | 17 | 25 | 26 |
| | Grade 10 | -- | 30 | 10 |
| | Grade 11 | -- | 8 | 2 |
| | Grade 12 | -- | 3 | 0 |
| | Other | 3 | 13 | 4 |
| | Don't know | 22 | 21 | 20 |

*Note: Not a choice on the survey for that staff member.

The response to Other was that the decisions are made over a period of years as students receive more information and participate in career discussions.

These results suggest that:

a. The percentage of students who have decided on a career and know the math requirements increases with grade.

b. Career decisions are made over the entire span of secondary school as students receive greater information and are ready to make career decisions. It is likely that some students make decisions earlier than others. In any event most decisions appear to be made by the end of grade ten.

2. Students' understanding of the mathematics requirements for graduation: CS 9, 10

| | | Current Students Grade 9 | 10 | 11 | 12 |
|---|---|---|---|---|---|
| How many credits are required for graduation? | 1 | 0 | 0 | 1 | 0 |
| | 2 | 14 | 69 | 70 | 74 |
| | 3 | 55 | 17 | 17 | 17 |
| | 4 | 13 | 4 | 5 | 5 |
| | 5 | 1 | 0 | 0 | 0 |
| | More than 5 | 1 | 1 | 1 | 0 |
| | I don't know | 16 | 9 | 6 | 4 |

| | | | | | |
|---|---|---|---|---|---|
| How many credits do you plan to earn in mathematics? | 1 | 1 | 1 | 2 | 0 |
| | 2 | 5 | 16 | 22 | 15 |
| | 3 | 15 | 24 | 26 | 23 |
| | 4 | 36 | 28 | 23 | 32 |
| | 5 | 16 | 13 | 10 | 9 |
| | More than 5 | 10 | 11 | 10 | 11 |
| | I don't know | 18 | 8 | 8 | 11 |

These results suggest that:

a. The percentage of students who know how many mathematics credits are required for graduation increases with grade.

b. Students in grades ten through twelve in 1983-84 are required to earn two math credits for graduation. Students in grade nine will be required to earn three credits. The data reflect these different requirements and indicate that most students are aware of them.

c. More than three-fourths of the students report that they plan to earn more than the minimal numbers of math credits required.

## D. HOW WELL ARE COUNTY STUDENTS SUCCEEDING IN MATHEMATICS?

**Results:**

1. Iowa Tests of Basic Skills (ITBS) -- Houghton-Mifflin TS

Anne Arundel County
Iowa Tests of Basic Skills
(Administered March/April annually)

Average Grade Equivalent for Grades 3, 5, 7, and 9 --1974-80

| | 1974 | 1975 | 1976 | 1977 | 1978 | 1979 | 1980 | Nat'l Norms |
|---|---|---|---|---|---|---|---|---|
| Grade 3 | | | | | | | | |
| Math Concepts | 3.6 | 3.7 | 3.8 | 3.8 | --b | 3.9 | 4.0 | 3.7 |
| Math Problems | 3.5 | 3.6 | 3.7 | 3.8 | -- | 3.9 | 4.0 | 3.7 |
| Math Total | 3.6 | 3.6 | 3.8 | 3.8 | -- | 3.9 | 4.0 | 3.7 |
| Grade 5 | | | | | | | | |
| Math Concepts | 5.6 | 5.5 | 5.7 | 5.7 | 5.8 | 5.8 | 5.9 | 5.7 |
| Math Problems | 5.4 | 5.4 | 5.5 | 5.6 | 5.6 | 5.7 | 5.9 | 5.7 |
| Math Total | 5.5 | 5.5 | 5.6 | 5.7 | 5.7 | 5.8 | 5.9 | 5.6 |
| Grade 7 | | | | | | | | |
| Math Concepts | 7.1 | 7.2 | 7.3 | 7.3 | 7.3 | 7.4 | 7.6 | 7.7 |
| Math Problems | 7.1 | 7.0 | 7.1 | 7.1 | 7.1 | 7.2 | 7.4 | 7.7 |
| Math Total | 7.1 | 7.1 | 7.2 | 7.2 | 7.2 | 7.3 | 7.5 | 7.6 |
| Grade 9 | | | | | | | | |
| Math Concepts | 8.8 | 8.6 | 8.7 | 8.7 | 8.7 | 8.8 | 8.8 | 9.6 |
| Math Problems | 8.4 | 8.3 | 8.5 | 8.6 | 8.6 | 8.7 | 8.7 | 9.2 |
| Math Total | 8.6 | 8.5 | 8.6 | 8.7 | 8.7 | 8.8 | 8.8 | 9.3 |

b. The mathematics subtests were optional during this school year and were not administered in all schools. A county average is, therefore, unavailable.

2. California Achievement Test (CAT)--McGraw-Hill

Anne Arundel County
California Achievement Test
(Administered October/November annually)

Average Grade Equivalent Score for Grades 3, 5, and 8--1980-84

| | 1980 | 1981 | 1982 | 1983 | 1984 | Nat'l Norms |
|---|---|---|---|---|---|---|
| Grade 3 | | | | | | |
| Math Concepts | 3.3 | 3.3 | 3.4 | 3.4 | 3.4 | 3.1 |
| Math Concepts and Application | 3.4 | 3.4 | 3.6 | 3.7 | 3.6 | 3.1 |
| Math Total | 3.3 | 3.4 | 3.5 | 3.5 | 3.5 | 3.1 |
| Grade 5 | | | | | | |
| Math Computation | 5.4 | 5.4 | 5.5 | 5.5 | 5.7 | 5.1 |
| Math Concepts and Application | 5.6 | 5.6 | 5.7 | 5.8 | 6.1 | 5.1 |
| Math Total | 5.5 | 5.5 | 5.6 | 5.6 | 5.9 | 5.1 |
| Grade 8 | | | | | | |
| Math Computation | 8.7 | 8.9 | 9.0 | 9.0 | 9.6 | 8.1 |
| Math Concepts and Application | 9.0 | 9.0 | 9.4 | 9.4 | 9.4 | 8.1 |
| Math Total | 8.9 | 9.0 | 9.1 | 9.2 | 9.3 | 8.1 |

As described in the Procedures section of this report, a sample of eleventh grade students was administered the mathematics subtests of the CAT. The results are reported below:

| Grade 11 | Grade Equivalent | Percentile Rank |
|---|---|---|
| Math Computation | 12.5 | 61 |
| Math Concepts and Application | 12.9 | 61 |
| Math Total | 12.5 | 61 |

3. Maryland Functional Mathematics Test (MFMT)--Maryland State Department of Education

Anne Arundel County
Maryland Functional Mathematics Test

Percent of Students Passing in Grades 7 and 9--1982-83

| | 1982 Fall | 1983 Fall | 1983 Total | 1984 Fall |
|---|---|---|---|---|
| Grade 7 | 15 | 19 | -- | 31 |
| Grade 9 | 42 | 58 | 79* | 67 |

*Includes all students who passed the MFMT during the 1983-84 school year. Students who did not take the test in the fall or who failed it were retested during the spring. This figure adds these students to the percentage passing. Ninth grade students who failed the test in the fall of 1984 will be retested in the spring of 1985.

4. Scholastic Aptitude Test (SAT)--Educational Testing Service

Anne Arundel County
Average Mathematics Score
Scholastic Aptitude Test

Average Mathematics Score for College-Bound Seniors

| | 1975 | 1976 | 1977 | 1978 | 1979 | 1980 | 1981 | 1982 | 1983 | 1984 |
|---|---|---|---|---|---|---|---|---|---|---|
| Anne Arundel | 477 | 480 | 479 | 474 | 478 | 467 | 464 | 468 | 464 | 471 |
| Maryland | 471 | 470 | 469 | 467 | 464 | 463 | 461 | 464 | 466 | 468 |
| Nation | 472 | 472 | 470 | 468 | 467 | 466 | 466 | 467 | 468 | 471 |

Special Subject Area Tests (Continued)

| | 1975 | 1976 | 1977 | 1978 | 1979 | 1980 | 1981 | 1982 | 1983 | 1984 |
|---|---|---|---|---|---|---|---|---|---|---|
| Math I | | | | | | | | | | |
| Anne Arundel | 568 | 567 | 575 | 559 | 569 | 555 | 560 | 561 | 562 | 561 |
| Maryland | 558 | 560 | 562 | 555 | 554 | 554 | 559 | 560 | 555 | 559 |
| Nation | 545 | 546 | 547 | 541 | 537 | 536 | 539 | 545 | 543 | 542 |
| Math II | | | | | | | | | | |
| Anne Arundel | 699 | 675 | 671 | 683 | 675 | 677 | 670 | 682 | 659 | 671 |
| Maryland | 681 | 683 | 683 | 683 | 673 | 669 | 673 | 672 | 669 | 673 |
| Nation | 660 | 665 | 666 | 665 | 657 | 653 | 654 | 661 | 655 | 659 |

5. Advanced Placement Tests (AP)--Educational Testing Service

Anne Arundel County
Advanced Placement Calculus

Numbers of Students Scoring at each Level--1981-84

| | Calculus AB | | | | Calculus BC | | | |
|---|---|---|---|---|---|---|---|---|
| AP Score | 1981 | 1982 | 1983 | 1984 | 1981 | 1982 | 1983 | 1984 |
| 5 | 6 | 4 | 2 | 24 | 2 | 1 | 4 | 2 |
| 4 | 6 | 9 | 21 | 42 | 2 | 6 | 3 | 10 |
| 3 | 16 | 48 | 32 | 67 | 10 | 13 | 16 | 17 |
| 2 | 4 | 39 | 37 | 36 | 8 | 19 | 13 | 7 |
| 1 | 1 | 32 | 48 | 23 | 13 | 39 | 20 | 10 |
| 3 to 5* | 25 | 61 | 55 | 133 | 14 | 20 | 23 | 29 |

Note: The Board of Education began paying for the AP examinations in 1982.

* A score of 3 or higher on the AP test will award a student college credit in that subject.

These results suggest that:

a. In grades 3, 5, 7, 8, and 9 county achievement in mathematics has risen over the last 10 years at each grade level tested.

b. County mathematics achievement in grades 3, 5, 8, and 11 is currently above the national norm in both the computation and concepts and application subtests.

c. Performance in grades 3, 5, and 8 has been higher in mathematics concepts and applications than computation. Ninth grade students scored higher in computation than in concepts and applications in the fall 1984.

d. The percentage of ninth grade students who passed the Maryland Functional Mathematics Test during fall testing increased from 42 percent in 1982-83 to 67 percent in 1984-85. The increase to 79 percent in the spring of 1984 includes the impact of testing all ninth grade students in the fall and retesting students who either failed or did not take the test during the fall during the following spring.

e. County mathematics performance on the SAT (college-bound students) has been variable in the last 10 years, up in some years, down in others. The average score for 1984 is the highest average score since 1979.

f. The largest drop in SAT scores (11 points) occurred in the 1979-80 school year. Score patterns have remained relatively stable since that time. There were no changes in the mathematics program during this time period. One suggestion that has been offered for this pattern is that the number of students applying to take the SAT has increased since 1979 to include students who had not been represented in the SAT scores previously.

(1) Since 1979-80, students applying for admission to the Anne Arundel Community College have taken the SAT (instead of the American College Test); and

(2) More students applied to take the SAT in 1981-82 when the Board of Education assumed the cost of the test.

g. County performance on the mathematics portion of the SAT is currently at the national average and above the Maryland average.

h. County performance on the SAT Special Subject Area Tests (Math I and II) has varied over the last 10 years, sometimes rising, sometimes falling. Currently the Math I score is 7 points lower than it was in 1975; the Math II score is 28 points lower. The Math I score is higher than the Maryland and national averages; the Math II score is above the national and two points below the Maryland average.

i. The number of students earning college credit through AP Calculus AB in 1984 (133) is five times higher than in 1981. The number of students earning college credit in AP Calculus BC has doubled from 14 to 29 in the same period.

## E. HOW SUCCESSFUL IN LATER MATHEMATICS COURSES ARE STUDENTS WHO ENROLL IN INTRODUCTION TO ALGEBRA AND ALGEBRA I IN GRADES SIX AND SEVEN, RESPECTIVELY.

1. <u>Screening for Introduction to Algebra in grade 6 and Algebra I in grade seven:</u> PA 37, 40 GC 32, 35 ET 106, 108 MJT 107

The responses of elementary, middle, and junior high teachers, principals, and guidance counselors indicate the following are the primary ways students are screened for Introduction to Algebra in grade six.

Note: The number in the parenthesis indicates the number of respondents giving that response.

Screening for Introduction to Algebra:

California Achievement Test Scores (107)
Teacher recommendation (91)
Gifted/Talented Program identification procedures (39)
Class performance (23)
Standardized tests (13)

Screening for Algebra I in grade seven:

Teacher recommendation (48)
Orleans-Hanna Algebra Prognosis Test scores (42)
Gifted/Talented Program identification procedures (23)
Successful completion of Introduction to Algebra (13)
Daily performance and work/study habits (12)

Success of screening process for Introduction to Algebra: SGRD

Two pieces of information provide some indication of the success of screening students in grade 5 for Introduction to Algebra in grade 6:

a. 243 sixth grade middle school students completed Introduction to Algebra during the 1983-84 school year. This year 230 students, or 95 percent, are enrolled in Algebra I as seventh graders in middle schools.

b. The 243 sixth grade students who completed Introduction to Algebra during the 1983-84 school year had the following distribution of grades. The County average is given for comparison purposes. The percentage of students in Introduction to Algebra and the percentage of students in the County in all secondary math courses receiving each final grade are reported below.

| | Final Grade | | | | |
|---|---|---|---|---|---|
| | A | B | C | D | E |
| Introduction to Algebra | 30 | 42 | 19 | 7 | 1 |
| Average of all secondary Math Courses | 9 | 25 | 31 | 21 | 13 |

Ninety-one percent of the sixth grade students enrolled in Introduction to Algebra earned a grade of C or better, compared to 65 percent of students on the average countywide in mathematics courses.

Success of screening process for Algebra I in grade 7:

Two pieces of information provide some indication of the success of screening of students in Introduction to Algebra for Algebra I in grade 7:

a. 457 seventh grade students completed Algebra I during the 1983-84 school year. This year 428 students, or 94 percent, are enrolled in Fused Geometry in grade eight.

b. The 457 students who completed Algebra I as seventh grade students during the 1983-84 school year had the following distribution of final grades in Algebra I. The percentages of students in Algebra I at each grade and the percentages of students in the County receiving each final grade in Algebra I are reported below.

| | Final Grade | | | | |
|---|---|---|---|---|---|
| | A | B | C | D | E |
| Algebra I | | | | | |
| Grade 7 | 22 | 40 | 25 | 10 | 3 |
| Grade 8 | 14 | 36 | 31 | 15 | 4 |
| Grade 9 | 7 | 21 | 31 | 24 | 16 |
| Grade 10 | 5 | 15 | 30 | 27 | 23 |
| Grade 11 | 5 | 14 | 24 | 28 | 30 |
| Grade 12 | 3 | 12 | 25 | 30 | 31 |
| Average of All Math Courses | 9 | 25 | 31 | 21 | 13 |

Eighty-seven percent of the seventh grade students who were enrolled in Algebra I earned a final grade of C or better, compared to 65 percent Countywide in mathematics courses. Realizing students who are more able mathematically enroll in Algebra I in grades 7 and 8, the distribution of final grades indicates that as grade level increases, the percentage of students earning A's and B's decreases while the percentage of students earning D's and E's increases. The students who receive the highest final grades in Algebra I are those who take the course in grade 7.

c. Attrition rate in Algebra I in grade 7 MJT 112

19 percent

These data suggest that:

a. Standardized achievement test scores and teacher recommendations are the major types of information used to screen students for both Introduction to Algebra in grade six and Algebra I in grade seven.

b. About 95 percent of the students who complete Introduction to Algebra in grade six and Algebra I in grade seven continue with Algebra I and Fused Geometry, respectively.

c. Ninety-one percent of the students who enroll in Introduction to Algebra in grade six and 87 percent of the students who enroll in Algebra I in grade seven earn a final grade of C or better.

d. The higher the grade level in which a student enrolls in Algebra I, the smaller the percentage of students who will earn a final grade of A or B and the larger the percentage of students who will earn a final grade of D or E.

e. About 20 percent of the students who begin Algebra I in grade seven do not complete the course.

2. Characteristics of students enrolled in Introduction to Algebra in grade six and Algebra I in grade seven: SGRD

Note: The following data is based upon the September 30, 1984, school enrollment data.

Percentage of Students Enrolled in Introduction to Algebra (Grade 6*), Algebra I (Grade 7 & 8), and Fused Geometry by Race and Sex

| | Asian | Black | Hispanic | Indian | White | Male | Female |
|---|---|---|---|---|---|---|---|
| Introduction to Algebra-Grade 6 | 3.1 | 1.7 | 0 | 0 | 95.2 | 47.1 | 52.9 |
| Algebra I-Grade 7 | 4.9 | 4.9 | 0 | 0 | 90.3 | 53.3 | 46.7 |
| Algebra I-Grade 8 | 3.0 | 4.4 | 0.2 | 0 | 91.2 | 45.9 | 54.1 |
| Fused Geometry-Grade 8 | 4.4 | 4.4 | 0.2 | 0 | 92.1 | 48.8 | 51.2 |
| Percentage in Total Enrollment - | 1.4 | 14.2 | 0.4 | 0.1 | 83.9 | 51.8 | 48.2 |

* Middle Schools only

These results suggest that a larger percentage of white and Asian students are enrolled in Introduction to Algebra, Algebra I, and Fused Geometry in grades six to eight than are represented in the total school population. A smaller percentage of black students are enrolled in these courses than are in the total school in the population. A higher percentage of males and lower percentage of females are enrolled in Algebra I in grade seven than are present in the total school population. It appears that slightly more males take Algebra I in grade seven and slightly more females in grade eight.

3. Students' perceptions of Introduction to Algebra and Algebra I in grades six and seven respectively: AI7 1, 2, 5, 19-22

| | Percent of students with Algebra 1 in grade 7 |
|---|---|
| Mathematics education they are receiving | |
| Satisfied | 78 |
| Dissatisfied | 8 |
| Number and variety of courses | |
| Satisfied | 76 |
| Dissatisfied | 8 |

The major reason given by students who took Algebra I in grade seven who are dissatisfied with their mathematics education was that the teaching methods used by teachers are not thorough (8).

Did Introduction to Algebra prepare you for Algebra I?

Yes 82

No 17

Students who answered that Introduction to Algebra did not prepare them for Algebra I report the main reason as Introduction to Algebra had no relationship to Algebra I (10).

How well prepared were you for mathematics courses taken after Algebra I?

| | Prepared or Well Prepared | Unprepared |
|---|---|---|
| Algebra II | 91 | 9 |
| Fused Geometry | 86 | 15 |

Was enrolling in Algebra I in grade seven a good decision? Would students do it again?

| | Yes | No |
|---|---|---|
| The decision was a good one | 78 | 18 |
| Would enroll in Algebra I in grade 7 again | 83 | 12 |

These data suggest that:

a. More than three-fourths of the students who took Algebra I in grade seven are satisfied with the mathematics education they are receiving and with the number and variety of courses offered.

b. Students believe that Introduction to Algebra prepared them for Algebra I and Algebra I for Fused Geometry and Algebra II.

c. More than three-fourths of the students who took Algebra I in grade seven believe that the decision was a good one; more than 80 percent would enroll in Algebra I in grade seven again.

4. In what courses do students who take Algebra I in grade seven later enroll? How successful are they in these courses? AI7 8-13

Listed below in decreasing order are the courses students report enrolling in after Algebra I in grade 7 (Note: These students were in grades 9 and 10 during the last school year.)

| Course | Percent of Students Who Report Enrolling |
|---|---|
| Fused Geometry | 89 |
| Algebra II | 75 |
| Trigonometry | 17 |
| Analytic Geometry | 16 |
| Computer Mathematics-Basic | 7 |
| Algebra III | 6 |
| Applied Mathematics | 3 |
| Independent Study | 2 |
| Elementary Functions, Probability and Statistics, Computer Mathematics-Fortran | Less than 1 |

Success in later mathematics courses: number of students earning each final grade in Algebra I compared with Fused Geometry and Algebra II.

| | Final Grade | Algebra I A | B | C | D | E |
|---|---|---|---|---|---|---|
| Fused Geometry | A | 52 | 30 | 16 | 2 | 0 |
| | B | 32 | 66 | 28 | 3 | 1 |
| | C | 4 | 26 | 17 | 7 | 1 |
| | D | 2 | 3 | 4 | 3 | 0 |
| | E | 0 | 0 | 1 | 1 | 1 |
| Algebra II | A | 55 | 18 | 3 | 1 | 0 |
| | B | 28 | 61 | 10 | 0 | 0 |
| | C | 5 | 33 | 15 | 0 | 0 |
| | D | 2 | 2 | 3 | 2 | 1 |
| | E | 0 | 2 | 4 | 1 | 0 |

For students who earned a C or higher in Algebra I in grade seven, 80 to 98 percent earned a grade within one letter grade of their Algebra I final grade in Fused Geometry and Aigebra II. Grade distributions in Algebra II and Fused Geometry were more varied for students who earned a D or E in Algebra I (however, this represents only 19 students out of 290).

Staff responses about success of students who take Algebra I in grade seven:

Does Introduction to Algebra adequately prepare students for Algebra I? MJT 62

| | Middle/Junior High School Teachers |
|---|---|
| Yes | 28 |
| No | 67 |

Teachers who responded that Introduction to Algebra does not adequately prepare students for Algebra I in grade 7 listed the lack of basic skills as the primary reason.

How do students who complete Algebra I in grade seven fare in later courses? MJT 115
SHS 104

Responses: they usually do well (especially if they have earned an A or B in Algebra I) (18); it is too early to tell (8); not very well (6).

Teachers of Introduction to Algebra in grade six in elementary schools were asked if they had enough time to complete the outline for Introduction to Algebra.

| | Teachers |
|---|---|
| Yes | 17 |
| No | 83 |

These results suggest that:

a. Two-thirds of the middle and junior high school teachers report that Introduction to Algebra does not adequately prepare students for Algebra I.

b. More than 80 percent of the elementary teachers report that they do not have enough time to complete the outline for Introduction to Algebra in grade six.

c. While the most common response teachers gave to the question, how well do students who complete Algebra I in grade seven do in later courses, was "they usually do well," other more varied responses were also given. Ninety-three to 100 percent of these students earn a final grade of C or higher in later mathematics courses taken.

5. Students enrolled in Algebra I and II and Fused Geometry prior to grade 9 who earn credit by examination? CBE

Credit by Examination

Number of Students Taking each Test and Receiving Credit

| | Algebra I | | | Fused Geometry | | | Algebra II | | |
|---|---|---|---|---|---|---|---|---|---|
| | Taking | Credit | | Taking | Credit | | Taking | Credit | |
| | No. | No. | % | No. | No. | % | No. | No. | % |
| 1982-83 | 613 | 403 | 66 | 78 | 52 | 67 | 53 | 41 | 77 |
| 1983-84 | 776 | 551 | 71 | 125 | 91 | 73 | 85 | 56 | 66 |
| 1984-85* | 667 | 467 | 69 | 274 | 196 | 72 | 32 | 16 | 50 |
| Total | 2,056 | 1,421 | 69 | 477 | 339 | 71 | 170 | 113 | 66 |

***Note:** Includes data for June, 1984. Exams were given again in February, 1985.

These data indicate that approximately two thirds of the students who take the mathematics examinations for credit earn high school credit.

6. Best sequence of courses following Algebra I in grade 7

MJT 64
SHT 90

| | Teachers: Middle/Junior High | Teachers: Senior High |
|---|---|---|
| Fused Geometry in grade 8 then Algebra II in grade 9 | 28 | 60 |
| Algebra II in grade 8 then Fused Geometry in grade 9 | 67 | 35 |

Middle/junior high teachers differed from senior high school teachers in their recommended sequence of courses following Algebra I. Middle/junior high school teachers recommended Algebra II followed by Fused Geometry; senior high school teachers recommended Fused Geometry followed in by Algebra II in grade nine.

7. What is the best sequence of courses for students who are unsuccessful in Introduction to Algebra or Algebra I in grades six and seven

PA 43, 44
MJT 113, 114
SHS 103

Following Introduction to Algebra: (grades 7, 8, and 9):
- Unified Math 7-8, Algebra I, Geometry (33)
- Algebra I in grade 8 (9)
- Repeat Introduction to Algebra (8)

Following Algebra I: (grades 8 and 9)
- Repeat Algebra I, Geometry (55)
- Unified Math 8, Algebra I (16)
- Algebra I, part 1 and Algebra I, part 2 (9)
- Students should be moved out of Algebra I early in the fall as soon as they fall below class standards (6)

The majority of teachers and administrators respond that students who are unsuccessful in Introduction to Algebra in grade six should take Unified Mathematics in grades seven and eight, Algebra I in grade nine and geometry in grade ten. The recommended sequence of courses for students who are unsuccessful in Algebra I in grade seven is to repeat Algebra I in grade eight followed by geometry in grade nine.

8. Characteristics of students successful and unsuccessful in Introduction to Algebra and Algebra I in grades six and seven:

GC 33, 34
36, 37
PA 38, 39, 41, 42
ET 109, 110
MJT 108-111

Introduction to Algebra (Grade 6)

Characteristics of Successful Students
- Mature, responsible, self-motivated (94)
- Good work/study habits (75)
- High ability/conceptual skills/reasoning/logic (68)
- High interest in mathematics (41)
- High achievement in mathematics (28)
- Good mathematics background, mastery of basic skills (26)

Characteristics of Unsuccessful Students
- Poor study/work habits (89)
- Poor motivation, persistence, and/or self-concept (40)
- Immature (32)
- Poor mathematics background (31)
- Can't keep up with the pace of the class (24)
- Improper placement (13)
- Home-related problems, parental pressure, lack of parent support (6)

Algebra I (Grade 7)

Characteristics of Successful Students
- Mature/responsible/persistent/self-motivated (66)
- Good work/study habits (53)
- High ability/conceptual skills/reasoning/logic (50)
- High achievement in mathematics/good math background (30)
- High interest in mathematics (13)
- Parental support (6)

Characteristics of Unsuccessful Students
- Poor work/study habits (49)
- Immature (35)
- Inadequate preparation/poor background (29)
- Lack of motivation (16)
- Low ability/inability to learn or to keep up (19)
- Unqualified/improper placement (11)
- Lack of interest (6)

In both Introduction to Algebra and Algebra I the most important student characteristics for success are maturity, responsibility, and good work habits; followed by ability and mathematics background. The most frequent reasons students are not successful are poor study and work habits, and lack of maturity, persistence, motivation, and responsibility.

9. Should Algebra I be offered in grade seven? PA 26 MJT 63 SHT 89

| | Principals Administrators | Teachers Middle/ Junior | Teachers Senior High |
|---|---|---|---|
| Yes | 51 | 54 | 44 |
| No | 45 | 44 | 52 |

The staff are divided over the issue of whether to offer Algebra I in grade seven. Respondents who indicated that Algebra I should not be offered in grade seven gave the following reasons (39 comments): Students lack the maturity and abstract thinking ability required, it should be offered very selectively, students are not prepared with the computational skills necessary for success, it results in a watered-down course, few students are prepared for the rigorous pace of the course, it should be offered only for the really gifted students, students are not learning the basics, and students need more work with the basic mathematics skills.

10. Number of students enrolled in Algebra I in grade 7 in each middle/junior high school, 1984-85 school year SGRD

| School | Number in Algebra I |
|---|---|
| Brooklyn Park J | 14 |
| Corkran J | 15 |
| Lindale J | 31 |
| Marley J | 18 |
| George Fox Middle | 19 |
| Severna Park Middle | 61 |
| Magothy River Middle | 21 |
| Chesapeake Bay Middle | 29 |
| Arundel Junior | 8 |
| MacArthur Middle | 25 |
| Crofton Junior | 26 |
| Old Mill Middle North | 17 |
| Old Mill Middle South | 14 |
| Annapolis Junior | 25 |
| Bates Junior | 23 |
| Southern Middle | 18 |
| Central | 26 |
| Total | 390 |

11. Additional comments made by students who were enrolled in Algebra I as seventh graders:



A final survey item asked students to comment on anything else they would like to tell about their experiences in Algebra I in grade seven. The comments are listed in descending order of frequency if they were made by five or more students and are classified by positive comments, negative comments, and specific changes suggested for the program. The numbers in parentheses represent the number of times each type of comment was made.

a. Positive Comments (25)

The program is a good one (for the intelligent and mature student), is challenging, and should be continued (19);
The teachers are good (6);

b. Negative Comments (44):

Poor teaching, teachers lacked interest in students, competency in subject matter, and teaching skills; explanations were not thorough or clear; didn't give enough help to students who needed it; spent too much time reviewing; didn't vary their teaching methods (29);

I was unprepared for Algebra I (10);

Students should not have to rely on Credit by Examination to earn credit for Algebra and Geometry completed prior to grade nine (5);

c. Specific Suggestions for Changes (17):

Need more advanced math courses for the student who has completed calculus by grade eleven (10);

Refine the selection and placement procedures (7).

F. WHAT ARE THE CHARACTERISTICS OF STUDENTS WHO SCHEDULE THE VARIOUS HIGH SCHOOL ELECTIVES?

1. Sex and Race: The percentage of secondary students enrolled in each mathematics course during the 1984-85 school year by sex and race: SGRD

| Course | RACE | | | | | SEX | | Total Enrollment |
|---|---|---|---|---|---|---|---|---|
| | A | B | H | I | W | M | F | |
| Unified Math 7 | 1.2 | 16.7 | 0.4 | 0.1 | 81.6 | 49.8 | 50.2 | 4881 |
| Unified Math 8 | 1.1 | 16.4 | 0.3 | 0.1 | 82.0 | 51.8 | 48.2 | 4587 |
| Unified Math 9 | 0.6 | 18.0 | 0.4 | 0.0 | 81.1 | 54.4 | 45.6 | 4710 |
| Unified Math 10 | 0.3 | 15.8 | 0.3 | 0.1 | 83.5 | 57.7 | 42.3 | 3212 |
| Unified Math 11 | 1.3 | 26.5 | 0.3 | 0.3 | 71.6 | 60.4 | 39.6 | 999 |
| Unified Math 12 | 0.0 | 39.7 | 0.0 | 0.0 | 60.3 | 66.7 | 33.3 | 156 |
| Algebra I, Part 1 | 1.6 | 26.8 | 1.3 | 0.5 | 69.9 | 49.8 | 50.2 | 265 |
| Algebra I, Part 2 | 1.1 | 24.2 | 0.2 | 0.2 | 74.2 | 49.1 | 50.9 | 879 |
| Algebra I | 1.6 | 8.5 | 0.4 | 0.2 | 89.3 | 52.4 | 47.6 | 6516 |
| Algebra II | 2.9 | 5.1 | 0.4 | 0.0 | 91.6 | 50.5 | 49.5 | 4252 |
| Algebra III | 3.9 | 3.9 | 0.5 | 0.0 | 94.1 | 61.3 | 38.7 | 204 |
| Intro. to Linear Algebra | 6.1 | 2.0 | 0.0 | 0.0 | 91.8 | 63.3 | 36.7 | 49 |
| Fused Geometry | 2.1 | 7.1 | 0.3 | 0.0 | 90.6 | 49.5 | 50.5 | 5537 |
| Analytic Geometry | 3.4 | 3.2 | 0.3 | 0.0 | 93.1 | 50.6 | 49.4 | 893 |
| Trigonometry | 3.6 | 3.6 | 0.2 | 0.0 | 92.5 | 50.6 | 49.4 | 990 |
| Elem. Functions | 4.1 | 0.8 | 0.8 | 0.0 | 94.3 | 54.9 | 45.1 | 122 |
| Prob. & Statistics | 4.2 | 0.7 | 0.7 | 0.0 | 94.4 | 65.3 | 34.7 | 144 |
| Calculus AB | 6.9 | 2.1 | 0.0 | 0.0 | 90.9 | 54.4 | 45.6 | 518 |
| Calculus BC | 2.3 | 1.1 | 0.0 | 0.0 | 96.6 | 61.4 | 38.6 | 88 |
| Computer Math 1A | 2.9 | 7.1 | 0.2 | 0.0 | 89.8 | 55.5 | 44.5 | 1270 |
| Computer Math 1B | 4.9 | 3.3 | 0.0 | 0.0 | 91.9 | 58.5 | 41.5 | 123 |
| Computer Math 2 | 2.8 | 3.6 | 0.0 | 0.0 | 93.7 | 71.1 | 28.9 | 253 |
| Adv. Computer Science | 4.3 | 4.3 | 0.0 | 0.0 | 91.5 | 78.7 | 21.3 | 47 |
| Applied Math | 0.9 | 14.7 | 0.5 | 0.0 | 83.9 | 58.4 | 41.6 | 428 |
| Business Math | 0.7 | 17.0 | 0.2 | 0.1 | 82.1 | 41.4 | 58.6 | 1675 |
| County Percentages | 1.4 | 14.2 | 0.4 | 0.1 | 83.9 | 51.8 | 48.2 | |

**Note:** Data for grade six was not included because scheduling data are available only for middle schools and not for elementary schools.

**Codes used in the above chart:** Race A=Asian, B=Black, H=Hispanic, I=American Indian, W=White
Sex M=Male, F=Female

These results suggest that:

a. The percentage of males and females is balanced in required courses such as Unified Math 7 and 8, and in Algebra I, Algebra II, Fused Geometry, Analytic Geometry, and Trigonometry. A higher percentage of males than females is enrolled in Unified Math 9 through 12, Algebra III, Introduction to Linear Algebra, Probability and Statistics, Calculus, and Computer Math. A higher percentage of females than males is enrolled in Business Math.

b. The distributions of males in math courses are more extreme than the distributions of females. That is, a higher percentage of males than females are enrolled in both academic and remedial mathematics courses.

c. The composition of courses by race varies by elective. The balance between black and white students matches that of the general school population in Unified Math 7 through 10 and Applied Math. A higher percentage of White students is enrolled in acdemic math courses than is represented in the general population, a lower percentage is enrolled in Unified Math 11 and 12 and Algebra I part one and two. A higher percentage of Black students is enrolled in Unified Math 11 and 12, Algebra I part 1 and 2, and Business Math than is represented in the total school population; a lower percentage is enrolled in academic math courses from Algebra I through Calculus. A higher percentage of Asian students is enrolled in academic math courses from Algebra I through Calculus and Computer Math then is represented in the total school population.

Ability and Achievement: The following table lists the mathematics elective courses and the average ability (Standard Age Score), mathematics computation and problem solving scores for the students enrolled in each course. This data was assembled to answer the question, "Do students elect courses designed for their ability and achievement levels?" CR

| Course | Non-verbal Ability (Standard Age Score) | Math Concepts (National Percentile) | Math Problem Solving (National Percentile) |
|---|---|---|---|
| Unified Math 9 | 99 | 26 | 33 |
| Unified Math 10 | 110 | 21 | 28 |
| Unified Math 11 | 99 | 26 | 33 |
| Unified Math 12 | 99 | 35 | 39 |
| Algebra I, Pt 1 | 102 | 25 | 34 |
| Algebra I, Pt 2 | 108 | 41 | 49 |
| Algebra I | 113 | 51 | 52 |
| Algebra II | 118 | 62 | 60 |
| Algebra III | 121 | 67 | 64 |
| Fused Geometry | 116 | 59 | 57 |
| Analytic Geometry | 126 | 74 | 69 |
| Trigonometry | 122 | 68 | 65 |
| Elementary Functions | 120 | 72 | 69 |
| Stat. & Probability | 122 | 66 | 58 |
| Calculus (AB) | 126 | 76 | 69 |
| Calculus II | 122 | 70 | 70 |
| Computer Math 1A | 118 | 62 | 63 |
| Applied Math | 107 | 39 | 44 |
| Business Math | 102 | 30 | 36 |
| Voc Ed Applied Credit | 104 | 34 | 36 |

Note: The above table has been produced from the test scores obtained from a sample of cumulative records of graduates of Anne Arundel Public Schools from 1978 through 1984. Specific tests represented are The Cognitive Abilities Test (Non-Verbal battery) and Iowa Tests of Basic Skills (Mathematics subtests), Houghton-Mifflin, 1971.

The data in this table suggest that:

> Students appear to be enrolling in the courses that match their ability and achievement levels. The average ability and achievement scores of students are higher for academic courses than for courses designed for the average student. Ability and achievement scores are lower for students in remedial math electives than for courses designed for the average student.

2. How many mathematics credits do graduates typically earn toward graduation? What are the characteristics of students who earn more than the two required credits? CR

Percentage of students earning each number of credits by program

| Number of Mathematics Credits | PROGRAM Academic | Business | Vocational | General |
|---|---|---|---|---|
| 2.0 | 6 | 71 | 51 | 38 |
| 2.5 | 6 | 10 | 19 | 21 |
| 3.0 | 22 | 17 | 20 | 25 |
| 3.5 | 12 | 1 | 5 | 5 |
| 4.0 | 31 | 1 | 3 | 9 |
| 4.5 | 8 | 0 | 1 | 1 |
| 5.0 | 9 | 0 | 1 | 1 |
| More Than 5.0 | 6 | 0 | 0 | 0 |
| Average Credits Earned | 3.7 | 2.3 | 2.5 | 2.7 |

Percentage of students earning each number of credits by race and sex

| | | RACE | | SEX | | |
|---|---|---|---|---|---|---|
| | | Black | White* | Male | Female | Total |
| | Number of Mathematics Credits | | | | | |
| | 2.0 | 52 | 40 | 33 | 48 | 41 |
| | 2.5 | 13 | 15 | 17 | 12 | 14 |
| | 3.0 | 21 | 22 | 22 | 21 | 22 |
| | 3.5 | 4 | 6 | 6 | 6 | 6 |
| | 4.0 | 9 | 12 | 15 | 8 | 11 |
| | 4.5 | 1 | 2 | 3 | 2 | 2 |
| | 5.0 | 1 | 3 | 3 | 2 | 2 |
| More Than | 5.0 | 0 | 1 | 2 | 1 | 1 |
| | Average Credits Earned | 2.6 | 2.8 | 2.9 | 2.6 | 2.8 |

* Note: The percentage of credits earned by Asian, Indian, and Hispanic students is not included because the number of students represented in the sample of cumulative records (8) is too small to be representative.

Has the number of mathematics credits earned by graduates changed over the years? To answer this question, the number of credits by graduation year was calculated for a sample graduates between 1978 and 1982 from the sample of cumulative records. The results are reported below.

Average Number of Mathematics Credits Earned by Graduation Year

| | GRADUATION YEAR | | | | | | |
|---|---|---|---|---|---|---|---|
| | 1978 | 1979 | 1980 | 1981 | 1982 | TOTAL | CR |
| Program | | | | | | | |
| Academic | 3.6 | 3.5 | 3.8 | 3.9 | 3.7 | 3.7 | |
| Business | 2.2 | 2.2 | 2.3 | 2.3 | 2.2 | 2.3 | |
| Vocational | 2.4 | 2.3 | 2.5 | 2.5 | 2.5 | 2.5 | |
| General | 2.5 | 2.7 | 2.6 | 2.7 | 2.7 | 2.7 | |
| Sex | | | | | | | |
| Male | 2.8 | 2.9 | 2.9 | 3.0 | 2.9 | 2.9 | |
| Female | 2.5 | 2.5 | 2.6 | 2.9 | 2.7 | 2.6 | |
| Race | | | | | | | |
| Black | 2.2 | 2.6 | 2.8 | 2.2 | 2.8 | 2.6 | |
| White | 2.7 | 2.6 | 2.7 | 3.0 | 2.8 | 2.8 | |
| Total | 2.7 | 2.7 | 2.8 | 2.9 | 2.8 | 2.8 | |

These results indicate that:

a. Most graduates from the Anne Arundel County Schools (58 percent) earn more than the required two credits in mathematics. The average number of credits earned was 2.8.

b. Students who were male, white, and in an academic program tended to earn more credits in mathematics than those who were female, black, and enrolled in a business, vocational, or general program of study.

c. The graduates appear to be earning slightly more mathematics credits in 1982 than in 1978. Although patterns vary from year to year and the increases are slight, an overall trend may be developing. It must be noted that these patterns developed at a time when two mathematics credits were required for graduation. It also appears that black students showed the greatest increase, earning about .6 math credits more in 1982 than in 1978.

3. Academic math program enrollment from grade to grade and year to year. SGRD CR

Enrollment in academic mathematics from grade to grade. Listed below are the number of enrollments and percentage of students in academic mathematics courses in grades seven through twelve during the 1984-85 school year. (Academic mathematics courses are: Algebra I, II, & III, Fused and Analytic Geometry, Trigonometry, Elementary Functions, Statistics and Probability, and Calculus AB and BC.)

| Grade | Total Enrollments | Percent of Total Grade Enrolled |
|---|---|---|
| 7 | 466 | 8 |
| 8 | 733 | 13 |
| 9 | 2195 | 39 |
| 10 | 2755 | 49 |
| 11 | 2773 | 54 |
| 12 | 2124 | 42 |

Enrollments in academic mathematics courses from year to year. Using the cumulative records of students graduating from the Anne Arundel County Public Schools between 1978 and 1982. The average number of students in academic mathematics courses and percentage of this number of the total sample of students for each graduation year is presented below. The academic courses are the same courses listed for the table above.

| Graduation Year | Number of Academic Enrollments | Percentage of Students Sampled |
|---|---|---|
| 1978 | 313 | 15 |
| 1979 | 374 | 16 |
| 1980 | 365 | 16 |
| 1981 | 426 | 18 |
| 1982 | 361 | 15 |

These data suggest that:

a. The enrollment in academic mathematics courses increases yearly from grade nine through eleven with a slight decrease in grade twelve. It must be noted that, with the exception of Algebra I and II, Fused Geometry, and AP calculus, all electives are one semester in length. Therefore, any student who is enrolled in more than one mathematics course during a school year will be counted more than once. Percentage figures represent the percentage of enrollments, not students, in academic mathematics courses.

b. The percentage of enrollments in academic mathematics courses increased between 1978 and 1981. The drop for the 1972 school year may be a one time phenomenon. The data for 1983 graduates shows an increase (16 percent) in enrollment. This data was not included in the table because the number of students sampled from the class of 1983 was less than half the size of the samples of the 1978-82 classes and was not as representative as the samples for earlier years. The sample was smaller because not all of the graduates' cumulative records were available on microfilm at the time the data from cumulative records was obtained.

4. What is the failure rate per mathematics course? How does it compare with the failure rate for English, social studies, science, and foreign languages? SGRD

The following table presents the percentage of students receiving each final grade for the 1983-84 school year, the average percentages for academic mathematics and all mathematics courses, and the average percentages for all secondary English, social studies, and science courses.

PERCENTAGE OF STUDENTS RECEIVING
FINAL GRADES

| Course | A | B | C | D | E |
|---|---|---|---|---|---|
| Unified Math 7 | 7 | 27 | 33 | 23 | 10 |
| Unified Math 8 | 5 | 30 | 34 | 21 | 10 |
| Unified Math 9 | 4 | 18 | 30 | 26 | 21 |
| Unified Math 10 | 5 | 17 | 30 | 25 | 21 |
| Unified Math 11 | 6 | 20 | 27 | 25 | 22 |
| Unified Math 12 | 6 | 18 | 30 | 29 | 16 |
| Algebra I, Pt. 1 | 8 | 24 | 31 | 23 | 14 |
| Algebra I, Pt. 2 | 8 | 23 | 33 | 24 | 13 |
| Algebra I | 8 | 22 | 29 | 23 | 17 |
| Fused Geometry | 12 | 28 | 31 | 19 | 10 |
| Algebra II | 11 | 25 | 29 | 21 | 14 |
| Algebra III | 19 | 26 | 34 | 13 | 8 |
| Trigonometry | 11 | 31 | 35 | 16 | 7 |
| Analytic Geometry | 15 | 32 | 36 | 13 | 4 |
| Elem. Functions | 22 | 44 | 27 | 7 | 0 |
| Prob. & Statistics | 32 | 41 | 15 | 7 | 5 |
| AP Calculus | 28 | 38 | 25 | 8 | 2 |
| Calculus II | 54 | 27 | 15 | 3 | 1 |
| Computer Math IA | 17 | 29 | 26 | 18 | 10 |
| Computer Math IB | 27 | 40 | 22 | 11 | 1 |
| Computer Math II | 28 | 29 | 27 | 13 | 3 |
| Applied Math | 6 | 17 | 26 | 26 | 24 |
| Independent Study | 68 | 14 | 9 | 5 | 5 |
| Academic Math Courses | 12 | 26 | 30 | 20 | 12 |
| All Math Courses | 9 | 25 | 31 | 22 | 14 |

Final Grade Distribution
Mathematics Courses Compared With Other Programs

| Program | FINAL GRADE A | B | C | D | E |
|---|---|---|---|---|---|
| Mathematics | 9 | 25 | 31 | 21 | 13 |
| English | 10 | 27 | 32 | 20 | 9 |
| Social Studies | 11 | 25 | 30 | 22 | 12 |
| Science | 11 | 25 | 31 | 21 | 11 |

These results suggest that:

a. Within the secondary mathematics courses offered, the highest percentage of failures occurs in courses such as Unified Math 9 through 12, Applied Math, and Algebra I while the lowest percentage of failure occurs in electives such as Probability and Statistics, AP Calculus, Calculus II, and Elementary Functions.

b. A comparison of the range of final grades earned in mathematics compared to other content areas shows the percentage of students earning each letter grade is fairly constant across programs, especially students earning B's, C's and D's. Fewer A's and more E's were earned in mathematics than in other program areas, but the differences are small.

5. Characteristics of students successful in high school academic mathematics courses

GC 38 PA 45
SHT 105

When asked to list the characteristics of students who are successful in high school academic mathematics courses, the various staff who were surveyed listed the following characteristics (in order of frequency). Numbers in parentheses are the number of times a particular characteristic was listed; only those characteristics listed five or more times are included.

Good study habits (i.e., completes homework, good class attendance) (60);
Highly able, bright, able to work abstractly (45);
Highly motivated (36);
Perseverance (29);
Self-disciplined, mature (14);
Parental support, good home life (13);
Curious (12);
Good background in mathematics (11);
Organized (9);
Goal-oriented (8);
Wants to go to college (7);
Interest in mathematics (7);
Positive attitude (6).

6. Reasons for students' failure in high school mathematics courses.

GC 39
PA 46
SHT 106
FS 22, 23
CS 36, 37

The final grade distributions in mathematics presented earlier show that on the average thirteen percent of students enrolled in mathematics courses receive a failing final grade. When current and former students were asked if they had ever failed a mathematics course they responded as follows:

When current students were asked if they had ever failed a mathematics course, 30 percent answered yes. Former students were asked if they had ever failed a mathematics course in high school. Eighteen percent responded that they had.

When asked to list the reasons for failing a mathematics course, the students gave the following responses.

I didn't study hard enough, didn't do homework, was absent too often (12);
Poor teaching, the teacher didn't explain the material well enough, the teacher went too fast (12);
I couldn't understand the material (9).

The following reasons were given by guidance counselors, school administrators, and senior high school teachers to explain why students experience failure in senior high school academic mathematics courses.

Poor study habits (including incomplete homework) (66);
Poor or weak background in mathematics (40);
Lack of interest, motivation, and/or self-discipline (29);
Poor attendance (19);
Too much time devoted to part-time work, sports, and other extra-curricular activities (13);
Improper placement (9);
Lack of parents' support and encouragement (9);
Poor instruction (8);
Poor attitude (6);
Low aptitude/ability for mathematics (5).

7. Reasons students do not enroll in additional mathematics courses beyond those required:

GC 40

Guidance counselors respond to this item with the following responses.

Students do not feel that they need additional mathematics courses (11);
They take what they need to meet college/graduation/employment requirements or the number of courses they believe are useful (10);
They do not see the value or necessity of additional courses beyond those required (7);
They already have all of the credits required (5).

G. WHAT ARE THE STUDENTS'/STAFF'S PERCEPTIONS ABOUT AWARDING VOCATIONAL STUDENTS ONE RELATED OR APPLIED MATHEMATICS CREDIT UPON COMPLETING TWO YEARS OF A TRADE? HOW DO STUDENTS WHO ARE AWARDED APPLIED MATH CREDITS AFTER COMPLETING TWO YEARS OF A TRADE COMPARE WITH NON-VOCATIONAL STUDENTS WHO EARN THEIR MATHEMATICS CREDITS IN MATHEMATICS PROGRAM OFFERINGS?

Note: Currently students who successfully complete two years of a vocational trade program may be awarded one related or applied mathematics credit. One part of the Mathematics Program evaluation attempted to address some concerns about the practice by surveying students and staff and by examining the mathematics program of non-trade students whose level of mathematics achievement was the same as a sample of trade students enrolled in vocational centers.

1. Perceptions about awarding applied mathematics credits to trade students

FS 20, 21
CS 33, 34
PA 31
SHT 95

Have you received any of your mathematics credits as an applied mathematics credit (asked of vocational students only)

| | Current Students | Former Students |
|---|---|---|
| Yes | 43 | 53 |
| No | 46 | 41 |
| I Don't Know | 11 | 6 |

Vocational students (both current and former) who had received an applied mathematics credit, as well as principals and senior high school mathematics teachers, were asked:

Do you believe that students enrolled in trade programs at the Vo-Tech Centers should receive an applied mathematics credit toward graduation upon satisfactorily completing two years of a trade program?

| | Current Students | Former Students | Principals | Senior High Teachers |
|---|---|---|---|---|
| Yes | 48 | 42 | 64 | 47 |
| No | 39 | 42 | 36 | 54 |

The results appear to be mixed on this issue. Applied math credits appear to be awarded to less than half of the students enrolled in trade programs, at least by student's own report. When asked if the awarding of applied mathematics credits is the best way to earn mathematics credits towards graduation, current and former trade students and senior high school teachers appear to be about equally divided on the question. Principals and other administrators, however, support awarding applied mathematics credits by two to one.

An additional piece of information related to this issue may be worth examining. Are students who received an applied vocational mathematics credit satisfied with their mathematics education?

| | Have Received Applied Math Credit (n=25) | Have Not Received Applied Math Credit (n=18) |
|---|---|---|
| Satisfaction with the mathematics education received | | |
| Satisfied | 60 | 67 |
| Dissatisfied | 8 | 6 |
| Satisfaction with the number and variety of math courses offered | | |
| Satisfied | 52 | 56 |
| Dissatisfied | 4 | 6 |
| Grade given to mathematics program | | |
| A or B | 56 | 41 |
| C | 44 | 41 |
| D or E | 0 | 18 |
| Grade given to mathematics teaching | | |
| A or B | 40 | 41 |
| C | 32 | 41 |
| D or E | 28 | 18 |

These results suggest that:

a. Vocational students who receive an applied vocational math credit do not differ from those who earned their two math credits by completing mathematics electives in their satisfaction with either the mathematics program or the number and variety of courses offered in high school.

b. Both groups of vocational students express slightly more satisfaction with the mathematics program than with the number and variety of courses available to them.

c. When compared to the total sample of current and former students, the vocational students do not differ in their satisfaction with the total mathematics program but do appear to be less satisfied with the number and variety of mathematics courses available to them. This is true whether a student has received an applied vocational math credit or not.

d. The distribution of grades given to the mathematics program and teaching is also consistent with the grades reported for former and current students. However, when students earning an applied vocational mathematics credit are compared with those not receiving any of their credits as an applied vocational math credit, they give the mathematics program higher grades and mathematics teaching about equal grades.

2. What kinds of courses do non-trades high school students take who have the same level of math achievement as trade students who earn an applied math credit? TS CR

In order to answer this question two samples of students were tested with the 11th grade level of the California Achievement Test mathematics subtests, a random sample of students in each high school and a random sample of students at vocational centers. The average achievement score of students at the votech centers was computed for each of the subtests and the total mathematics subtests. All students in the high school sample whose mathematics achievement matched that of the average vocational center student were identified. (Students were identified from the high school sample were chosen if their test scores were within one-half a standard deviation of the mean

scores of vocational students on both math subtests.) The mathematics courses and grade point average of these high school students were examined.

The specific issue addressed is this. Students enrolled in trade programs can earn up to one mathematics credit by successfully completing two years of a trade in lieu of completing a mathematics course offering. It has not been previously known how these trade students compare with students who earn their math credits by enrolling in mathematics courses through the mathematics curriculum. Listed below is a description of 36 students who have earned their two credits toward graduation by enrolling in mathematics courses in the high school and whose current level of mathematics achievement exactly matches that of the trade students tested.

| Course | Percent Enrolled | Average Final Grade | |
|---|---|---|---|
| Unified Math 9 | 66 | 2.85 | Where |
| Business Math | 50 | 1.85 | A=4 |
| Unified Math 10 | 44 | 1.74 | B=3 |
| Algebra 1 | 34 | 0.91 | C=2 |
| Algebra I, Pt. 1 | 16 | 1.00 | D=1 |
| Algebra I, Pt. 2 | 13 | 1.60 | E=0 |
| Unified Math 11 | 13 | 1.75 | |
| Fused Geometry | 9 | 0.86 | |
| Applied Math | 9 | 2.00 | |

Math credits earned towards graduations (all students are in grade 12 this school year.)

| Number of Credits | Percent of Sample |
|---|---|
| 1.0 | 3 |
| 1.5 | 3 |
| 2.0 | 81 |
| 2.5 | 3 |
| 3.0 | 9 |

Percent of the sample who have failed a mathematics course during at least one semester= 50 percent

Grade 11 Grade Point Average of the Sample= 1.85

Average Nonverbal Standard Age Score (Ability) of the sample= 105.7

From the data available, the following observations can be made:

a. Vocational trade students who are earning one of their math credits as an applied vocational credit have the same level of mathematics achievement as sample non-trade students in the high schools who have earned their two graduation credits by successfully completing courses in the mathematics program of study.

b. If these vocational students completed their graduation requirements through mathematics electives, it can be projected that they would have the following characteristics and experience:

Slightly above average in ability

Grade point average of 1.85

Would most likely enroll in Unified Math 9 or 10, Business Math, or Algebra I

One out of two students would receive a failing grade in math at least one semester, fewer than one in ten would receive an A during any semester.

Would be most likely to succeed in courses like Unified Math, Applied Math, or Business Math

Would be least likely to succeed in course like Algebra I and Fused Geometry.

## H. ADDITIONAL COMMENTS MADE BY STUDENTS ABOUT MATHEMATICS PROGRAM

FS 24
CS 52

All surveys contained a final item which asked the respondents to comment on anything else they would like to tell about their experiences with the Mathematics Program. Summarized below are the responses from the current students and graduates who were surveyed. The number in the parentheses represent the number of times each comment was made.

1. Positive Comments (95):

   The Mathematics Program is a good one, it has a good variety of courses (42);

   I had good math teachers, they were knowledgeable and went out of their way to help students (27);

   The math courses helped me in college mathematics (10);

   I regret that I did not take more math courses in high school (9);

   I learned a considerable amount of math in high school that I use everyday (7).

2. Negative Comments (98):

   Teachers did not explain the material clearly, teachers should be better qualified, had poor teaching skills, emphasized repetition rather than understanding a problem (59);

   Teachers gave very little individual help (18);

   Teachers/counselors did not stress the importance of a strong math background for college or encourage students to take more than the bare minimum of mathematics for credit (9);

   Teachers were not interested in students, did not show enough care and concern for students (7);

   Classes were too large, they were difficult for teachers to control (5).

3. Specific suggestions made (34):

   Provide more computers, computer courses, or work with computers (9);

   Include more applications to everyday life in the mathematics content of courses, such as how to handle personal finances (8);

   Offer more upper level/advanced math classes or a greater variety of math courses (7);

   Require students to take more math courses (5);

   Improve the quality of the teachers and teaching, more teacher evaluation, and hire the teachers with the best records and experience not just those that are most available (5).

SUMMARY. The major findings related to students' mathematics performance, attitudes and later success are:

1. The majority of students surveyed, both current and former, express satisfaction with their mathematics education and the number and variety of math courses available to them; award the mathematics program and teaching a grade of A or B; and express positive attitudes about mathematics and its usefulness to them.

2. Seventy to 86 percent of graduates report that the mathematics courses they took in high school prepared them for additional math courses taken since graduation and/or for the math knowledge and skills required on the job. About half of the graduates report that they have taken a math course since high school graduation and that they wish they had taken additional mathematics in high school; eighty percent of the graduates report that their job occasionally requires a knowledge of math and math skills.

3. Career decisions and awareness of the mathematics required for them occur over the entire span of secondary school and increase with grade level. Generally students appear to know the math credit requirements for graduation (although the recent increase in mathematics credit requirements apparently caused some confusion among students). Approximately three-fourths of last years' secondary students plan to earn three or more credits in mathematics toward high school graduation (including those for whom the two credit requirement still applies). About one-half of the students plan to earn four or more credits in mathematics.

4. County achievement in mathematics has risen over the last ten years at each grade tested and is currently above the national norm. The percentage of ninth graders passing the Maryland Functional Mathematics Test on first attempt has increased from 42 percent in 1982 to 67 percent this year. County performance on the mathematics portion of the Scholastic Test has been variable over the last ten years. Currently the score is above the state and at the national average and appears to be increasing. The number of students earning college credit in AP Calculus was five times higher in 1984 than in 1981, before the Board of Education began paying for the test administration.

5. The majority of students who begin introduction to Algebra in grade seven continue through Fused Geometry. More than 90 percent of the middle school students who complete Introduction to Algebra in grade six enroll in Algebra I in grade seven; more than 90 percent continue on in Fused Geometry. Approximately 90 percent of the students enrolled in Introduction to Algebra and Algebra I earn a final score of C or better. A larger proportion of white and Asian students and a smaller percentage of black students are enrolled in Introduction to Algebra, Algebra I, and Fused Geometry than are represented in the total system population. A larger percentage of males take Algebra I in grade seven than females.

6. The majority of students who enroll in Algebra I in grade seven are satisfied with their mathematics education and would do it again. Eighty to 98 percent of students who earn a C or higher in Algebra I in grade seven earn a final grade within one letter grade in Algebra II and Fused Geometry. Failures in Introduction to Algebra and Algebra I are primarily due to poor work/study habits, poor motivation and persistence, immaturity, and poor math background.

7. Staff percentions on the issue of offering Introduction to Algebra in grade six and Algebra I in grade seven are mixed. Two-thirds of the teachers report that Introduction to Algebra does not adequately prepare students for Algebra I; more than 80 percent of the elementary teachers report that they do not have enough time to complete the outline for Introduction to Algebra in grade six, and staff is mixed in its opinion whether Algebra I should be offered to students in grade seven to the extent it is now offered.

8. An examination of the secondary school mathematics electives revealed that a higher percentage of males, Asian, and white students and a lower percentage of black and female students are enrolled in the academic math courses than are represented in the total school population. It also appears that students are enrolling in math courses which match their abilities and achievement levels. Ability and achievement levels are higher for academic courses than for courses designed for non-academic students.

9. Most graduates from the Anne Arundel County Public Schools between 1978 and 1982 earned more than the two mathematics credits required for graduation. The number of mathematics credits earned over a five year period appears to be on the increase with black students showing the greatest increases during this period.

10. The highest student failure rate in mathematics occurs in courses such as Unified Math and Applied Mathematics, while the lowest percentage of failures occurs in the highest level academic courses such as Probability and Statistics, Calculus, and Elementary Functions.

11. Principals, guidance counselors, and teachers report that students who are successful in high school academic mathematics courses have good study habits and perseverance, and are highly motivated, bright, mature, and self-disciplined. Conversely, students who experience failure in high school academic math courses have poor study habits, a poor background in math, little interest in mathematics, and low motivation, self-discipline, and attendance.

12. The majority of vocational students, both those who receive an applied mathematics credit after completing two years of a trade and those who did not, appear to be satisfied with their mathematics education and do not differ from non-vocational students in this regard. However, they are less satisfied with the number and variety of mathematics courses available to them than non-vocational students and tend to give the mathematics program slightly lower grades.

    If vocational trade students completed their mathematics requirements by enrolling in math electives, they would most likely have the following characteristics: earned two mathematics credits, a grade point average less than 2.0; most likely enrolled in Unified Math 9 or 10, Business Math, or Algebra I. One in two is likely to have received a failing grade at least one semester. In short, students who earn a mathematics credit as an applied credit by completing two years of a trade have the same math experiences as students who have earned their two credits by successfully completing mathematics program electives, but who tend to be less successful in mathematics.

    The issue of whether or not to award applied math credits to vocational students is not resolved by the data. Both vocational students who have and who have not received an applied mathematics credit express satisfaction with the mathematics education they have received or are receiving. Students and mathematics teachers are divided on the issue; about half believe that applied math credits should be awarded and about half believe that they should not. School administrators believe that applied math credits should be awarded.

## III. MATHEMATICS INSTRUCTION

Source of Data

INTRODUCTION. The questions in this section of the evaluation report address a series of issues about mathematics instruction, such as implementation of the curriculum, teachers' preparation in mathematics, staff development needs, instructional strategies used in mathematics, the role of microprocessors in mathematics instruction, mathematics curriculum guides, and teachers' class sizes and teaching loads.

### A. HOW HAS THE MATHEMATICS CURRICULUM BEEN IMPLEMENTED IN GRADES K THROUGH 12?

1. Implementation of the County mathematics curriculum

PA 3
ET 5
MJT 5
SHT 5

To what degree has the mathematics curriculum been implemented:

| | PRIN & ADMIN | TEACHERS ELEM | TEACHERS M/JHS | TEACHERS SHS |
|---|---|---|---|---|
| To a great degree | 64 | 62 | 68 | 43 |
| To an adequate degree | 34 | 35 | 31 | 51 |
| To a little degree | 2 | 3 | 1 | 4 |
| Not at all | 0 | LT 1* | 0 | 2 |

*LT 1 = Less Than 1 percent

At least 94 percent of all respondents indicated that the curriculum is implemented at least to an adequate degree if not better. Less than six percent of the respondents at any level, whether administrators or teachers, answered that the degree of implementation was small or non existent. It appears apparent by staff self-report that the Anne Arundel County Mathematics Curriculum is being implemented across the county at all levels. However, fewer high school mathematics teachers responded that the curriculum is implemented to a great degree than elementary or middle/junior high school teachers.

In addition to the broad question of curriculum implementation a series of specific questions about curriculum implementation was asked about such topics as articulation, time allocations, differences in math instruction in grade six at elementary and middle schools, school organization for math instruction, and combination classes. Each of these topics will be dealt with separately in the section of the evaluation report that immediately follows.

2. Articulation across grades and courses

ET 37,38
MJT 33,34
SHT 26,27
CS 50

Teachers were asked the question whether or not they knew the content and skills taught in the grades/courses that immediately preceded and followed the ones they taught and current students were asked if they thought their mathematics teachers this year knew what they had been taught in math courses last year. The intent of these questions was to determine if articulation exists across grades and courses as the mathematics curriculum is implemented. The results are reported below.

| | TEACHERS ELEM | TEACHERS M/JHS | TEACHERS SHS | STUDENTS |
|---|---|---|---|---|
| GRADE/ COURSE PRECEDING | | | | |
| Yes | 88 | 82 | 95 | 61 |
| No | 7 | 15 | 3 | 24 |
| I don't know | 5 | 3 | 2 | 16 |
| GRADE/ COURSE FOLLOWING | | | | |
| Yes | 85 | 85 | 91 | |
| No | 11 | 12 | 5 | |
| I don't know | 5 | 4 | 3 | |

Teachers clearly report that they know the content and skills of courses which immediately precede and follow the ones they teach. Senior high school mathematics teachers, especially, report knowing the content/skills of preceding courses. Students' perceptions about teachers' knowledge about course content is not in complete accord. Although the majority of high school students report that their math teachers knew what they had studied in previous courses, less than two-thirds report so, compared with more than 80 percent of the teachers.

3. Time allocated to mathematics instruction

PA 35
ET 62,104
MJT 57
CS 51

a. Elementary schools. County guidelines suggest that the following amounts of time be allocated to mathematics instruction in the elementary schools:

| | |
|---|---|
| Kindergarten | Mathematics content and skills in the kindergarten curriculum are integrated within activities throughout the day rather than scheduled during a set interval of time. For example, the calendar is a regular activity during the opening activities, counting may occur during snack time, classification of graphic and/or color patterns can easily be an integral part of child-selected activities or play, etc. Specific teacher directed mathematics instruction is also regularly scheduled. |
| Grades 1 through 3 | 175 minutes of mathematics instruction per week. |
| Grades 4 through 6 | 195 minutes of mathematics instruction per week. |

Elementary administrators and teachers were asked how much time teachers spend weekly in mathematics instruction and how the instruction is scheduled over five days.

Where grade level was indicated (primary or intermediate) administrators report following the county guidelines. They report that on the average 177 minutes of instruction in mathematics occurs in grades 1 through 3, and that 197 minutes of mathematics is provided in grades 4 through 6.

The average number of minutes of mathematics instruction in elementary schools reported by elementary school administrators and teachers (excluding separate time estimates for primary and intermediate grades) was:

| | | |
|---|---|---|
| Elementary Administrators | 227 | minutes per week or |
| | 45 | minutes per day |
| Elementary Teachers | 217 | minutes per week or |
| | 43 | minutes per day |

Most of the responses of the time allocated to mathematics instruction were given for a week. Where teachers and administrators responded how the time was scheduled over five days, their responses indicated that math instruction occurred daily and that the amount of time allocated to math instruction each day was equal.

In a related question, elementary teachers were asked how many minutes of direct mathematics instruction each student receives daily, discounting seatwork. ET 44

| | Percent Responding |
|---|---|
| Five minutes or less | 3 |
| 6-10 minutes | 8 |
| 11-15 minutes | 20 |
| 16-20 minutes | 27 |
| 21-25 minutes | 18 |
| 26-30 minutes | 11 |
| 31-35 minutes | 4 |
| 36-40 minutes | 3 |
| 41-45 minutes | 2 |
| More than 45 minutes | 1 |

b. Time allocations in secondary schools.

Time allocations for mathematics instruction in secondary schools are determined by the length of class periods. In middle and junior high schools the length of class periods and, therefore, daily math instruction, ranges from 48 to 55 minutes in length. Classes at senior high schools range from 47 to 55 minutes in length.

c. Amount of time allocated for mathematics homework.

Math teachers were asked to estimate how long it requires students to complete the homework assigned to be done outside of class. Current students were asked to estimate how long it took them to do the mathematics homework assigned to be done outside of class. Their responses to these questions were:

ET 62
MJT 57
SHT 50
CS 51

| Estimated Time | TEACHERS ELEM | TEACHERS M/JHS | TEACHERS SHS | CURRENT STUDENTS |
|---|---|---|---|---|
| 1-15 minutes | 50 | 20 | 3 | 19 |
| 16-30 minutes | 46 | 64 | 55 | 43 |
| 31-45 minutes | 3 | 16 | 36 | 13 |
| 46-60 minutes | 1 | 0 | 6 | 16 |
| More than 60 minutes | 0 | 0 | 0 | 9 |

These results reveal that the amount of homework assigned increases from elementary school to senior high school. Ninety-six percent of elementary school teachers of mathematics assign mathematics homework of 30 minutes or less. Eighty percent of middle/junior high school teachers and 91 percent of senior high school mathematics teachers give homework assignments that they estimate will require students 15 to 45 minutes to complete. Few teachers assign homework in mathematics that they believe will require more than 45 minutes to complete. Students currently in senior high school report that it requires more time to do their homework than teachers estimate. Twenty-five percent of the students surveyed report that it requires more than 45 minutes to complete their homework; 56 percent report that it takes 15-45 minutes to complete their homework. Nineteen percent of the students report that they can finish their mathematics homework in 15 minutes or less.

4. Effect of mathematics instruction in kindergarten on the elementary school mathematics curriculum PA 36 ET 105

Elementary principals and teachers of mathematics were asked to respond how mathematics instruction in kindergarten has influenced the elementary school mathematics curriculum. The responses given five or more times are listed below. (Numbers in parentheses indicate the number of times a particular response was given.)

Elementary Principals and Administrators

It prepares students for the elementary school math curriculum (28);
It has a very positive effect (20).

Elementary Teachers

Mathematics instruction in kindergarten lays the foundation for all future mathematics instruction (85);
Students have a better understanding of beginning mathematics concepts (34);
Increasing students' number awareness is beneficial (30);
The effect on the elementary school mathematics curriculum has been good/helpful (28);
It provides a foundation for the first grade curriculum and allows formal mathematics instruction to go forward on the expected time line (10);
First grade children are better prepared in addition and subtraction (9);
It saves time in first grade teaching some of the basic principles of mathematics (9);
It formulates the beginning of problem solving concepts (8);
It helps to develop a positive attitude toward math (5).

5. Elementary school organization for mathematics instruction

PA 20
ET 35,103

When asked how their elementary school was organized for mathematics instruction, principals and teachers gave the following responses.

| | PRINCIPALS | TEACHERS |
|---|---|---|
| Mathematics instruction is departmentalized | 33 | 17 |
| Mathematics instruction is self-contained (each teacher is responsible) | 42 | 75 |
| Mathematics instruction occurs by some other type of organization | 25 | 7 |

When other was chosen, the following types of organization were specified

Students are grouped by ability (with teachers teaching a specific ability group) (19);
Organization is a combination of departmentalization and self-contained (10);
Flexible grouping is used, students are regrouped based upon their performance (8);
Team teaching with other teachers (6).

When elementary teachers were asked if they had any feelings or comments about how mathematics instruction is organized, they gave the following responses:

Prefer mathematics to be departmentalized in elementary schools or find departmentalization to be more effective (104);
Find mathematics taught in self-contained classrooms to be most appropriate especially in the primary grades, it helps the teacher to understand the whole child (resource teachers can provide necessary support) (75);
Prefer mathematics classes to be grouped homogeneously (e.g., by ability or math skills level) (25).

6. Combination classes in elementary school

ET 36
PA 22

Elementary principals and teachers were asked to respond to the effect on combination classes (e.g., teaching grades 3 and 4 together) on mathematics instruction.

Do teachers teach mathematics to any combination classes?

| | TEACHERS | PRINCIPALS |
|---|---|---|
| Yes | 19 | 55 |
| No | 81 | 45 |

When asked to respond to the effect of combination classes on mathematics instruction, teachers and principals gave the following responses.

Positive Comments: Combination classes are better for students and teachers, increase the effectiveness of instruction, provide teachers with more flexibility, and enable students to be grouped according to their needs (14).

Negative Comments: There is little time for individual instruction with each group, it is difficult to group students, and it may slow down math instruction (15).

7. Math instruction in elementary and middle school sixth grade

PA 23,24
AI7 4,5,6

Principals and other school administrators were asked whether Unified Math 6 and Introduction to Algebra offered in elementary schools was comparable to the courses when offered in middle schools.

Is course comparable in elementary and middle schools?

| | Unified Math 6 | Intro to Algebra |
|---|---|---|
| Yes | 20 | 22 |
| No | 12 | 18 |
| Do not know | 68 | 60 |

Most school administrators responded that they did not know if the two courses were comparable in elementary and middle schools.

When the response was that the courses are not comparable, comments indicated that the courses are more effective in the middle school than in the elementary schools.

The comments for Unified Math 6 were that grouping is more appropriate, instruction is scheduled daily, instruction is provided by a math specialist, there is less interruption for courses such as music, art, and phys ed, and that planning time is allotted to the staff and department head more in the middle school compared to the elementary (7).

The comments for Introduction to Algebra were that more instructional time is devoted to mathematics instruction daily, there is more depth of coverage, students in Introduction to Algebra are in a separate class, there is more direct teaching, and instruction is provided by a math specialist more in a middle school than in an elementary.

A related piece of information is provided by students who completed Introduction to Algebra in grade six in an elementary or middle school.

Did Introduction to Algebra prepare you for Algebra I?

| | Instruction Occurred In Elementary School | Middle School |
|---|---|---|
| Yes | 79 | 90 |
| No | 21 | 11 |
| Final grade received in Algebra I | | |
| A | 30 | 33 |
| B | 36 | 46 |
| C | 25 | 17 |
| D | 6 | 3 |
| E | 3 | 1 |

Only one out of three administrators was able to respond to the question of comparability of math instruction at sixth grade in elementary and middle schools with a yes or no. Of those who responded, administrators were fairly evenly divided on the issue. The percentage of respondents answering yes and no did not differ significantly. Principals who responded that the instruction was not comparable uniformly agreed that Unified Math 6 and Introduction to Algebra were more effective when offered in middle schools due to scheduling, the ability to form intact classes rather than combinations classes, and because the teachers are certified in mathematics.

Students who received their Introduction to Algebra in a middle school were more likely to say that they were prepared for Algebra I in grade seven than those who received Introduction to Algebra in elementary school, although both groups overall reported being prepared. Differences in end of course grades in Algebra I did not differ significantly from students who received it in elementary and middle schools.

## B. WHAT ARE TEACHERS' PREPARATION FOR AND EXPERIENCES IN TEACHING MATHEMATICS?

### 1. Profile of Anne Arundel County Mathematics Teachers

POD
ET 3,4
MJT 3,4
SHT 3,4

Note: The following data has been provided by the Personnel Office for the 1983-84 and 1984-85 school years, unless otherwise noted.

a. Number of mathematics teachers. There were 275 individuals employed by the Board of Education to teach Mathematics during 1983-84, including the Coordinator of Mathematics and three mathematics resource teachers. Of these, 249 (91 percent) had mathematics as their main teaching assignment. There were 26 teachers (9 percent) who were assigned to teach mathematics for less than a major portion of the day, either as part-time teachers or teachers whose major assignment was in a field other than mathematics. For the 1984-85 school year 234 individuals are employed to teach math full time in secondary schools. In addition 31 teachers are teaching mathematics for less than a major portion of the day. A listing of mathematics teacher's assignments provided by the Department of Instruction reveals that of the 31 secondary teachers who are teaching at least one math class this fall fifteen are employed on a part-time basis and 16 are full-time teachers whose main teaching responsibilities lie in an area other than mathematics (science, 6; English, distributive education, music, and industrial arts, program, 1). With the increase in mathematics credits for graduation from two to three during the 1985-86 school year, the Coordinator of Mathematics estimates that 13 additional mathematics teachers will be needed at the secondary level.

b. Average ages and years of teaching experience. (Based upon the teachers during the 1983-84 year.)

age: Mean = 38, Range = 23 to 68 years. Years of Teaching Experience: Mean = 11, Range = 1 to 31 years.

c. Mathematics certification

Secondary

Secondary teachers teaching mathematics as their major assignment (249) teachers during the 1983-84 school year)

| Certification | |
|---|---|
| Mathematics (grades 5-12) | 76 percent |
| Elementary (grades 1-6) plus mathematics (grades 7-9) | 8 percent |
| Elementary (grades 1-6) plus middle school | 24 percent |
| Other (provisional certificate or teaching out of field) | 1 percent |
| Percentage of mathematics teachers holding the appropriate certificate | 99 percent |

Note: Percentage will total to more than 100 percent because some teachers hold certification in two or more of the three mathematics certification areas.

Secondary teachers teaching mathematics as a minor portion of their assignment (26 teachers)

| | |
|---|---|
| Percentage of part-time mathematics teachers holding the appropriate certificate | 11 percent |
| Percentage of all mathematics teachers holding the appropriate certificate | 91 percent |

Elementary

Based upon the data from the elementary teachers who teach mathematics, the following areas of certification were reported.

| Certification | |
|---|---|
| Mathematics (grades 5-12) | 1 percent |
| Elementary (grades 1-6) plus mathematics (grades 7-9) | 6 percent |
| Elementary (grades 1-6) plus middle school | 77 percent |
| Early Childhood Education | 21 percent |
| Other | 8 percent |

Other areas of certification reported by teachers of elementary mathematics were

Special education (elementary or K-12) (12 teachers), reading or reading specialist (11), supervision and administration (3), and English (3).

d. Qualification to teach Advanced Placement Calculus

The Guidelines for Advanced Placement (AP) Programs recommend that a three-phase staff training program be required of all teachers of AP courses. Phase I of the training is an inservice provided by representatives of the College Board; Phase II of the training consists of AP teachers meeting with readers of the Advanced Placement Examinations and discussing the criteria for scoring these papers; Phase III of the training includes in-house sessions for AP teacher to share their instructional strategies.

Currently there are 16 AP Calculus teachers. Of these, 14 (88 percent) have completed Phases I and II. Three AP Calculus teachers have completed Phase III.

These data reveal that the average mathematics teacher in Anne Arundel County has 11 years of teaching experience. Ninety-nine percent of the secondary teachers with full-time math teaching responsibilities hold the appropriate certificate for their assignment; 84 percent specifically have certification in mathematics. In contrast, elementary teachers hold certification in elementary or early childhood education with seven percent having a specific certification in mathematics. Finally, of the 16 high school teachers of AP Calculus, 88 percent have complete phases I and II of the recommended staff development program.

2. Teachers' perceptions about the County mathematics curriculum and their preparation to teach it

PA 6
ET 13,14
MJT 11,12
SHT 13,14

Are teachers comfortable teaching the Anne Arundel County Mathematics Curriculum?

| | PRINCIPALS | TEACHERS ELEM | TEACHERS M/JHS | TEACHERS SHS |
|---|---|---|---|---|
| Yes | 82 | 95 | 97 | 89 |
| No | 10 | 4 | 3 | 11 |
| I don't know | 8 | 2 | 1 | 0 |

The following reasons were given when the response was that teachers are not comfortable teaching the County mathematics curriculum.

Virtually all comments made by or about teachers who are not comfortable teaching the County math curriculum were made by principals and elementary teachers. The three reasons most often listed were that the textbooks do not reflect the curriculum and a need for uniformity in textbooks (6); a need for curriculum guidelines for each grade level (3); and that the curriculum is not challenging enough for students (3).

Are you prepared to teach the County Mathematics Curriculum?

| | TEACHERS ELEM | TEACHERS M/JHS | TEACHERS SHS |
|---|---|---|---|
| Yes | 97 | 98 | 100 |
| No | 3 | 2 | 0 |
| I don't know | 1 | 0 | 0 |

These data suggest that teachers are both comfortable teaching the County mathematics curriculum and feel that they are prepared to teach it.

3. How many mathematics teachers are hired each school year? How many mathematics teachers retire or resign each school year?

POD

| | SCHOOL YEAR 1982-1983 | SCHOOL YEAR 1983-1984 |
|---|---|---|
| Number of mathematics teachers employed | 21 | 23 |
| Middle school | 4 | 2 |
| Junior high | 7 | 8 |
| Senior high | 10 | 13 |
| Number of mathematics teachers resigning | 10 | 19 |

| Reasons for resignations | | |
|---|---|---|
| Work other than teaching | 4 | 6 |
| Home responsibility | 2 | 2 |
| Dissatisfaction with teaching | 1 | 2 |
| College teaching | 1 | 0 |
| Teaching elsewhere | 0 | 1 |
| Further study | 1 | 1 |
| Failed to meet Advanced Professional Certif. | 0 | 2 |
| Moved from area | 0 | 1 |
| Military reasons | 0 | 1 |
| Resigned after signing contract prior to beginning teaching | 0 | 1 |
| Retired | 1 | 2 |

The question of how the number of mathematics teachers who have resigned and are leaving teaching compares with teachers in other content areas has been addressed by examining the number of teachers who have resigned to pursue a career other than teaching or because they were dissatisfied with teaching in mathematics compared with other content/teaching levels.

| Content/ Teaching Area | Number of Teachers Resigning Due to Dissatisfaction or to Work in a Field Other than Teaching |
|---|---|
| Mathematics | 8 |
| Business Education | 1 |
| Elementary Education | 7 |
| English and/or Reading | 4 |
| Industrial Arts | 4 |
| Physical Education | 2 |
| Science | 4 |
| Science/English | 1 |
| Social Studies | 2 |
| Special Education | 5 |
| Speech Therapy | 1 |

These data suggest that resignations of teachers in mathematics is higher than in other content fields and may be increasing.

C. WHAT ARE MATHEMATICS TEACHERS' STAFF DEVELOPMENT INTERESTS AND NEEDS?

1. Types of instructional assistance received by mathematics teachers

ET 66-76
MJT 65-75
SHT 54-64
SDO
MO

| Assistance | PERCENT RECEIVING ASSISTANCE | | | PERCENT RECEIVING ASSISTANCE REPORTING IT HELPFUL | | |
|---|---|---|---|---|---|---|
| | ELEM | M/JHS | SHS | ELEM | M/JHS | SHS |
| Working with team leader or math dept. chair | 20 | 78 | 86 | 95 | 98 | 100 |
| Working with the principal | 39 | 44 | 46 | 96 | 90 | 93 |
| Working with the asst. principal or intern | 17 | 32 | 46 | 98 | 91 | 86 |
| Working with another math teacher | 50 | 81 | 89 | 98 | 99 | 100 |
| Graduate courses in math education | 32 | 56 | 67 | 88 | 78 | 88 |
| County workshops in math education * | 52 | 60 | 68 | 95 | 87 | 85 |
| Working with Coord. of Mathematics | 27 | 50 | 42 | 91 | 95 | 92 |
| Working with math resource teachers | 51 | 42 | 39 | 94 | 85 | 77 |
| Using County developed curriculum materials | 66 | 72 | 68 | 95 | 90 | 93 |
| Using professional journals | 59 | 71 | 68 | 97 | 95 | 95 |
| Other | 34 | 43 | 24 | 82 | 92 | 100 |

Other types of instructional assistance that teachers report receiving and using are:

Early Childhood Staff Development Center, aides, curriculum materials from other LEAs, supplementary workbooks, Gifted/Talented Program Inservice, assistance from media specialists/computers, computer math games, inter-departmental assistance, and college texts.

*Listed below are the enrollments for the Credit and Non-Credit Mathematics Workshops Offered by the Offices of Staff Development and Mathematics, Fall 1982 through Spring 1984.

| Credit Workshops | Participants |
|---|---|
| Computer Programming and Computer Use | 169 |
| Advanced Computer Programming and Use | 14 |
| Computer Applications in Unified Mathematics | 7 |
| Using Computers in the Mathematics Classroom | 10 |
| Intro to Algebra Content and Strategies | 9 |
| Problem Solving in Secondary Math | 8 |
| G/T Mathematics Student | 3 |
| Geometry: Content and Strategies | 11 |
| Total Enrollment in Math Credit Workshops | 231 |

| Non-Credit Workshops | Participants |
|---|---|
| Functional Mathematics | |
| Elementary | 456 |
| Middle/Junior | 63 |
| Senior | 79 |
| Effective Grouping | 58 |
| Test Taking Skills | 106 |
| Problem Solving | 204 |
| Effective Use of Manipulatives | 203 |
| Computer Usage | 157 |
| Curriculum Implementation | 51 |
| Active Teaching Model | 131 |
| Mathematics Competition | 57 |
| Long-Range Planning | 55 |
| Introduction to Algebra | 26 |
| Mathematics Production | 57 |
| Calculators | 74 |
| Total Enrollment in Math Non-Credit Workshops | 1779 |

Mathematics Certification/Upgrade Program.

In 1982 the Board of Education approved a program in cooperation with the University of Maryland to enable teachers uncertified in mathematics teachers to become certified and to enable certified mathematics teachers to upgrade their level of mathematics certification.

University of Maryland Off-Campus Mathematics Certification Program. Of the 46 individuals who began this program in 1982, 31 (67 percent) have completed the course requirements and have received certification in mathematics. Currently there are 39 teachers who began the second offering of the math certification program in the fall of 1984.

University of Maryland Off-Campus Mathematics Upgrade Program. This program is designed to enable teachers currently certified in mathematics to upgrade or increase the level of mathematics they are certified to teach. Because of the different backgrounds of mathematics teachers, there is no one sequence of courses all must take to upgrade their certification. Listed below are the courses and enrollment through fall 1984.

| Course | Teachers Enrolled in or Completing Course |
|---|---|
| Linear Algebra | 22 |
| Introduction to Analysis (Calculus Refresher) | 23 |
| Differential Equations for Teachers | 9 |
| Paschal | 28 |
| Introduction to Number Theory | 7 |

2. Is inservice sufficient to insure that the mathematics curriculum is implemented? PA 18, ET 77, MJT 76, SHT 65

Are there enough inservice opportunities available to teachers to ensure that the mathematics curriculum is taught effectively?

| | TEACHERS | | | |
|---|---|---|---|---|
| | PRIN | ELEM | M/JHS | SHS |
| Yes | 57 | 69 | 74 | 79 |
| No | 34 | 12 | 15 | 11 |

Respondents who indicated that there were not enough inservice opportunities available listed the following inservice topics most frequently: teaching methods and strategies, computer literacy, and hands on manipulatives.

3. To what degree do teachers participate in professional educational and mathematics organizations? ET 97-99, MJT 100-102, SHT 97-99

| | PERCENTAGE OF TEACHERS BELONGING | | |
|---|---|---|---|
| | ELEM | M/JHS | SHS |
| National Council for Teachers of Mathematics * | 2 | 22 | 29 |
| Maryland Council for Teachers of Mathematics | 2 | 23 | 25 |
| Other organizations of mathematics educators | 6 | 6 | 20 |

*Note: Forty-eight schools subscribe to the Arithmetic Teacher the journal of the National Council for Teachers of Mathematics. Teachers have access to this professional publication at their school without joining the organization.

Other organizations listed by teachers were the National Association of Science Teachers, National Statistics Institute, Kappa Mu Epsilon and Pi Mu Epsilon (Math Honorary Societies), the National Education Association, the Maryland Education Association, and the Teachers Association of Anne Arundel County.

## D. WHAT INSTRUCTIONAL STRATEGIES, ORGANIZATIONS, AND STUDENT DATA DO TEACHERS USE TO TEACH MATHEMATICS IN GRADES KINDERGARTEN THROUGH TWELVE?

### 1. Instructional strategies used

ET 45-61
MJT 40-56
SHT 33-49
CS 17-32

Note: Surveys for staff and current students asked how often each of the following teaching strategies were used in mathematics instruction.

| Instructional Strategy | TEACHERS ELEM | M/JHS | SHS | STUDENTS |
|---|---|---|---|---|
| **Drill** | | | | |
| Daily | 38 | 82 | 60 | 58 |
| Two to three times a week | 38 | 12 | 24 | 19 |
| About once a week | 17 | 4 | 12 | 10 |
| Once or twice a month | 2 | 0 | 1 | 3 |
| Less than once a month | 2 | 0 | 2 | 2 |
| Never | 3 | 2 | 1 | 7 |
| **Lectures** | | | | |
| Daily | 31 | 55 | 62 | 57 |
| Two to three times a week | 24 | 28 | 30 | 22 |
| About once a week | 10 | 9 | 1 | 11 |
| Once or twice a month | 4 | 3 | 1 | 3 |
| Less than once a month | 6 | 2 | 2 | 3 |
| Never | 26 | 4 | 3 | 5 |
| **Discussion** | | | | |
| Daily | 63 | 66 | 53 | 43 |
| Two to three times a week | 25 | 19 | 23 | 27 |
| About once a week | 8 | 9 | 11 | 12 |
| Once or twice a month | 2 | 4 | 7 | 5 |
| Less than once a month | 1 | 2 | 4 | 5 |
| Never | 2 | 1 | 2 | 8 |
| **Teacher demonstrations** | | | | |
| Daily | 59 | 60 | 68 | 63 |
| Two to three times a week | 34 | 30 | 19 | 20 |
| About once a week | 6 | 6 | 4 | 9 |
| Once or twice a month | 2 | 0 | 5 | 3 |
| Less than once a month | 0 | 3 | 2 | 2 |
| Never | LT 1 | 1 | 1 | 3 |
| **Written work (dittos, work sheets)** | | | | |
| Daily | 58 | 49 | 44 | 66 |
| Two to three times a week | 31 | 36 | 26 | 19 |
| About once a week | 7 | 13 | 22 | 8 |
| Once or twice a month | 3 | 2 | 7 | 3 |
| Less than once a month | 1 | 1 | 2 | 2 |
| Never | LT 1 | 0 | 0 | 3 |
| **Board work** | | | | |
| Daily | 31 | 43 | 39 | 13 |
| Two to three times a week | 34 | 29 | 25 | 15 |
| About once a week | 18 | 16 | 20 | 20 |
| Once or twice a month | 9 | 5 | 5 | 15 |
| Less than once a month | 4 | 4 | 8 | 16 |
| Never | 4 | 3 | 3 | 21 |
| **Student presentations** | | | | |
| Daily | 14 | 12 | 10 | 3 |
| Two to three times a week | 21 | 24 | 19 | 4 |
| About once a week | 18 | 15 | 20 | 9 |
| Once or twice a month | 11 | 11 | 10 | 7 |
| Less than once a month | 18 | 23 | 23 | 10 |
| Never | 19 | 15 | 20 | 68 |

| | | | | | |
|---|---|---|---|---|---|
| Learning stations | | | | | |
| Daily | | 17 | 6 | 3 | 3 |
| Two to three times a week | | 18 | 3 | 1 | 2 |
| About once a week | | 18 | 3 | 1 | 2 |
| Once or twice a month | | 15 | 9 | 3 | 3 |
| Less than once a month | | 13 | 18 | 10 | 5 |
| Never | | 20 | 62 | 82 | 85 |
| Simulations and games | | | | | |
| Daily | | 13 | 4 | 1 | * |
| Two to three times a week | | 23 | 3 | 1 | |
| About once a week | | 29 | 13 | 1 | |
| Once or twice a month | | 23 | 36 | 21 | |
| Less than once a month | | 9 | 34 | 52 | |
| Never | | 3 | 10 | 24 | |
| Discovery Learning | | | | | |
| Daily | | 13 | 11 | 9 | * |
| Two to three times a week | | 21 | 18 | 14 | |
| About once a week | | 32 | 27 | 28 | |
| Once or twice a month | | 20 | 29 | 20 | |
| Less than once a month | | 11 | 12 | 22 | |
| Never | | 5 | 4 | 8 | |
| Inquiry or problem solving | | | | | |
| Daily | | 14 | 17 | 44 | * |
| Two to three times a week | | 35 | 29 | 33 | |
| About once a week | | 39 | 36 | 16 | |
| Once or twice a month | | 9 | 9 | 5 | |
| Less than once a month | | 3 | 6 | 1 | |
| Never | LT | 1 | 3 | 1 | |
| Television, film, or other media presentation | | | | | |
| Daily | | 1 | 1 | 1 | 2 |
| Two to three times a week | | 2 | 1 | 2 | 1 |
| About once a week | | 12 | 5 | 9 | 2 |
| Once or twice a month | | 25 | 16 | 53 | 7 |
| Less than once a month | | 39 | 59 | 34 | 13 |
| Never | | 23 | 19 | 0 | 76 |
| Administering tests and quizzes | | | | | |
| Daily | | 1 | 2 | 1 | 5 |
| Two to three times a week | | 9 | 11 | 12 | 14 |
| About once a week | | 56 | 81 | 80 | 71 |
| Once or twice a month | | 25 | 5 | 5 | 7 |
| Less than once a month | | 4 | 1 | 1 | 1 |
| Never | | 5 | 0 | 0 | 1 |
| Tutoring students outside of class | | | | | |
| Daily | | 3 | 10 | 7 | * |
| Two to three times a week | | 10 | 35 | 49 | |
| About once a week | | 17 | 39 | 33 | |
| Once or twice a month | | 15 | 7 | 10 | |
| Less than once a month | | 15 | 8 | 1 | |
| Never | | 41 | 2 | 1 | |
| Assigning homework to be done in class | | | | | |
| Daily | | 13 | 16 | 29 | 29 |
| Two to three times a week | | 13 | 21 | 15 | 31 |
| About once a week | | 6 | 14 | 20 | 18 |
| Once or twice a month | | 6 | 13 | 14 | 7 |
| Less than once a month | | 7 | 16 | 9 | 6 |
| Never | | 54 | 20 | 13 | 9 |

| | | | | |
|---|---|---|---|---|
| Assigning homework to be done outside of class | | | | |
| Daily | 29 | 73 | 87 | 62 |
| Two to three times a week | 38 | 26 | 11 | 23 |
| About once a week | 14 | 2 | 1 | 8 |
| Once or twice a month | 7 | 0 | 0 | 1 |
| Less than once a month | 4 | 0 | 1 | 2 |
| Never | 8 | 0 | 0 | 4 |
| Other | | | | |
| Daily | 20 | 16 | 15 | * |
| Two to three times a week | 17 | 9 | 15 | |
| About once a week | 6 | 9 | 6 | |
| Once or twice a month | 8 | 6 | 15 | |
| Less than once a month | 4 | 9 | 0 | |
| Never | 46 | 50 | 50 | |

*Question not asked on this survey

When respondents selected Other as the response to the types of instructional strategies and activities used in mathematics classrooms, the most common example given was to have students begin homework in class and finish it at home (5).

These data suggest that:

a. Daily math instruction in elementary schools entails discussion, teacher demonstrations, and written work; in secondary schools drill, lectures, discussions, and teacher demonstrations predominate.

b. Although elementary teachers use learning stations about once a week, secondary teachers rarely use them. Additionally, elementary teachers use simulations, games, and discovery learning more than secondary teachers and use inquiry and problem solving less often.

c. Current high school students and senior high school teachers generally agree on the types of instructional strategies used and the frequency of them, although students perceive they do more written work in class and less board work than do teachers.

d. Weekly quizzes and daily math homework occur more frequently in secondary schools than in elementary schools.

2. Grouping students for mathematics instruction

ET 39-43
MJT 35-39
SHT 28-32
CS 12-15

Note: Staff were asked to respond how often they used a variety of ways to group students for mathematics instruction. Students were asked how often they worked in each of the types of groupings listed. The responses to these items are as follows:

| | TEACHERS | | | |
|---|---|---|---|---|
| Grouping Strategy | ELEM | M/JHS | SHS | STUDENTS |
| Total class presentations or discussions | | | | |
| Daily | 49 | 75 | 75 | 62 |
| Two to three times a week | 24 | 20 | 12 | 21 |
| About once a week | 9 | 3 | 4 | 9 |
| Once or twice a month | 8 | 1 | 2 | 3 |
| Less than once a month | 6 | 0 | 4 | 2 |
| Never | 4 | 2 | 2 | 3 |
| Discussions, group work, or projects in two or more groups | | | | |
| Daily | 44 | 8 | 11 | 9 |
| Two to three times a week | 29 | 14 | 9 | 7 |
| About once a week | 12 | 17 | 9 | 13 |
| Once or twice a month | 8 | 25 | 32 | 16 |
| Less than once a month | 6 | 30 | 28 | 15 |
| Never | 1 | 6 | 12 | 42 |

| | | | | | |
|---|---|---|---|---|---|
| Independent work | | | | | |
| Daily | | 79 | 71 | 62 | 77 |
| Two to three times a week | | 15 | 8 | 14 | 14 |
| About once a week | | 4 | 5 | 2 | 5 |
| Once or twice a month | | 1 | 4 | 7 | 1 |
| Less than once a month | LT | 1 | 7 | 10 | 1 |
| Never | | 0 | 5 | 5 | 3 |
| Teacher-student work on a one-to-one basis | | | | | |
| Daily | | 43 | 51 | 52 | 14 |
| Two to three times a week | | 31 | 26 | 28 | 17 |
| About once a week | | 17 | 12 | 12 | 18 |
| Once or twice a month | | 5 | 8 | 4 | 15 |
| Less than once a month | | 2 | 4 | 2 | 37 |
| Never | LT | 1 | 0 | 1 | |
| Other | | | | | |
| Daily | | 17 | 18 | 28 | 35 |
| Two to three times a week | | 13 | 21 | 17 | 12 |
| About once a week | | 21 | 12 | 0 | 17 |
| Once or twice a month | | 16 | 12 | 11 | 4 |
| Less than once a month | | 8 | 3 | 3 | 5 |
| Never | | 26 | 35 | 42 | 27 |

When respondents selected Other as the type of instructional grouping used, they listed the following other types of groupings used for instruction more than five times: tutoring (29) and teams (5).

These data suggest that:

a. Total class presentations and discussions are more frequently used in secondary schools than in elementary while, elementary teachers rely more often on work in two or more groups.

b. Over three-fourths of the teachers report that students work independently at least once a week.

c. Teachers report working with a student on a one-to-one basis more often than do students. (This data is probably realistic and consistent since the probability that a teacher works individually with students on a given day is higher than the probability that an individual student receives assistance from a teacher on a given day.)

3. Information used to assign students to instructional groups or courses

a. Assigning students to instructional groups/courses.

PA 10-17,25, 29,30
GC 12-19,20-24, 26,29,30
MJT 87-89
SHT 76-78,91, 93

School administrators and guidance counselors report the following types of information are used to assign students to instructional groups or courses:

| Type of information | SCHOOL ADMINISTRATOR ELEM | M/JHS | SHS | COUNSELORS |
|---|---|---|---|---|
| California Achievement Test Scores | 87 | 100 | 63 | 85 |
| Teacher made test scores | 98 | 86 | 84 | 74 |
| Math basic textbooks completed | 62 | 29 | 32 | 31 |
| Scores from end of unit tests in basic texts | 67 | 15 | 16 | 24 |
| Informal assessments | 93 | 82 | 84 | 76 |
| Maryland Functional Math Test scores | 13 | 86 | 90 | 63 |
| Information on Individual Mathematics Records | 18 | 48 | 21 | 37 |
| Other | 39 | 88 | 42 | 58 |

Other types of information used to assign students to mathematics instructional groups or courses are:

Teacher recommendation (16);
Orleans-Hanna Algebra Prognosis Test (for Algebra I) (9);
Grades (current and/or previous) (7); and
Stanford Diagnostic Mathematics Test (7).

b. Counselor's knowledge of student's math skills

In a related area, secondary guidance counselors were asked a series of questions about their knowledge of students performance in mathematics, the intent being that this information is relevant to appropriate placement of students in grade groups or courses for instruction.

Guidance counselors responded as follows:

Do you know -

| | Yes | No |
|---|---|---|
| which students assigned to you failed the Maryland Functional Mathematics Test? | 93 | 7 |
| what skills students who fail the Maryland Functional Mathematics Test need to learn? | 62 | 38 |
| the seven Unified Mathematics strands? | 21 | 79 |
| on which strands ninth graders performed poorly this year? (answered only by counselors who answered Yes to the question above) | 44 | 56 |

c. A specific question was asked of principals and guidance counselors concerning how students are assigned to Unified Math in grades 9 through 12. Their responses were:

| Methods of Assigning | PRINCIPALS | COUNSELORS |
|---|---|---|
| Grade Level | 14 | 3 |
| Ability | 27 | 46 |
| Grade level and ability | 55 | 44 |
| Other | 5 | 3 |

Other types of information listed included teacher recommendation and the Maryland Functional Mathematics Test.

In a related set of questions senior high school teachers and administrators were asked whether teachers teach Unified Math to any ungraded classes and whether there were any differences in Unified Math 9-12 as they are implemented.

Their responses:

Sixty-five percent of the senior high school mathematics teachers report teaching Unified Mathematics to ungraded classes (e.g., students from grades 9-12 together).

Are there any differences between Unified Math in grades 9 through 12 as the courses are implemented?

| | Yes | No |
|---|---|---|
| Senior high school administrators | 78 | 0 |
| Senior high school math teachers | 73 | 14 |

d. Information used to assign students to math classes

Counselors were asked two open-ended questions which allowed them to respond more fully to the issue of how students are assigned to sections/courses for math instruction and what procedures were used to ensure that students were correctly placed in math classes/courses.

How are students assigned to sections/courses for math instruction? Responses given five or more times are listed.

Teacher recommendation (41);
California Achievement Test Scores (15);
Ability level (14);
Previous grades (10);
Performance on achievement tests (7);
Classroom performance (7);
Informal assessments (7); and
Mathematics department recommendation (5).

What procedures do you follow to ensure that students are correctly placed in mathematics classes/courses?

Teachers request change if placement is inappropriate (23);
Test scores - achievement, diagnostic, entry (21);
Follow-up by teacher, parent, student, administrator, department (18);
Courses previously taken, interim report cards, and grades (14);
Continued evaluation and placement input (13);
Diagnostic test scores (5).

e. A final set of questions was asked of secondary administrators, counselors, and mathematics teachers whether adjustments could be made in a student's placement other than at the end of a semester. Secondary teachers were also asked if they checked to ensure that a student's placement was appropriate and whether they had a choice in what mathematics course or level a student was placed.

Can adjustments be made in a student's placement other than at the end of the semester?

| | TEACHERS | | PRINCIPALS | | COUNSELORS | |
|---|---|---|---|---|---|---|
| | M/JHS | SHS | M/JHS | SHS | M/JHS | SHS |
| Yes | 90 | 77 | 100 | 90 | 100 | 65 |
| No | 10 | 23 | 0 | 11 | 0 | 35 |

When a student enrolls in a mathematics course you teach, do you check to insure that his/her placement is appropriate?

| | TEACHERS | |
|---|---|---|
| | M/JHS | SHS |
| Yes | 84 | 84 |
| No | 17 | 16 |

In addition teachers report that they use the following to check to insure that a student's placement is appropriate: previous records, tests, information from previous teachers, informal assessments, standardized tests, observation of work, asking students, grades, placement tests, and information in the guidance office.

Do you have a choice in what mathematics course or level a student is placed?

| | TEACHERS | |
|---|---|---|
| | M/JHS | SHS |
| Yes | 71 | 65 |
| No | 29 | 35 |

Taken together, these data suggest the following about assigning students to instructional groups or courses:

(1) The California Achievement Test, teacher-made test scores and informal assessments are widely used to assign students to instructional groups or courses at all levels. Elementary teachers widely use mathematics basic texts completed and tests from end of basic texts while secondary schools use the Maryland Functional Mathematics Test results to assign students.

Counselors report that teacher recommendation is the most frequent piece of information used to assign students to sections/courses for math instruction. Other information used are achievement/ability test scores, previous grades, and classroom performance.

(2) Teachers check to ensure that students are correctly placed in a math class/course, report (as do principals and guidance counselors) that adjustments can be made in a student's placement other than at the end of a semester, and report that they have a choice in what math course or level a student is placed.

(3) Students are assigned to Unified Mathematics in grades 9 through 12 by a combination of grade level and ability. Although 65 percent of senior high school math teachers report teaching Unified Mathematics to ungraded, classes, both senior high school teachers and administrators agree that there are differences in Unified Mathematics 9 through 12 as they are implemented.

(4) Guidance counselors know which students assigned to them have failed the Maryland Functional Mathematics Test and what skills these students need to learn. Since performance on unified mathematics strands is not reported as information used to assign students to mathematics courses/sections, it is not surprising that most counselors are not familiar with this component of the Unified Math Program.

3. What types of instruments, criteria, and/or data do teachers use to assess students' instructional needs and mastery?

ET 78-95
MJT 77-86, 90-97
SHT 66-75, 79-86

Reported below are the percentage of teachers who report using each of the following types of information to diagnose students' instructional needs at the beginning of instruction and to assess students' mastery at the end of a course.

| | TEACHERS | | | | | |
|---|---|---|---|---|---|---|
| | ELEMENTARY | | MIDDLE/JHS | | SENIOR HS | |
| Instrument/Data | BEGIN | END | BEGIN | END | BEGIN | END |
| Norm referenced standardized tests | 27 | 34 | 51 | 17 | 21 | 23 |
| Published criterion referenced tests | 19 | 21 | 32 | 21 | 21 | 20 |
| Teacher made tests | 84 | 91 | 93 | 97 | 88 | 99 |
| Tests in textbooks or teachers' guides | 83 | 88 | 62 | 82 | 69 | 70 |
| Informal assessments/inventories | 88 | 82 | 80 | 68 | 81 | 51 |
| Cumulative records | 36 | * | 59 | * | 58 | * |
| Anecdotal records | 30 | * | 22 | * | 31 | * |
| Individual Mathematics Record | 33 | 41 | 27 | 16 | 52 | 25 |
| Class records | 63 | 63 | 52 | 53 | 46 | 50 |
| Other | 22 | 15 | 56 | 13 | 20 | 22 |

*This type of information would be inappropriate to use to assess mastery at the end of instruction.

Other types of instruments/data listed were:

To diagnose needs at the beginning of instruction -
teacher observation, background information, inventories, individual tests, teacher judgement, and information from former teachers and counselors.

To assess mastery at the end of a course -
graphs showing progress in the fundamentals and unit tests.

These data suggest that: At the beginning of instruction teachers use teacher-made tests, tests in textbooks or teacher's guides, informal assessments and inventories, and class records to assess students' needs. Secondary teachers also use cumulative record data (elementary teachers use this less frequently) and middle/junior high school teachers use norm referenced test data. At the end of instruction teacher-made tests are those most frequently used to assess mastery, although tests in textbooks and class record are also used.

4. Individual Mathematics Record: Is it maintained? How is it best used? ET 102 MJT 106

The number of teachers reporting that they maintain the Individual Mathematics Record was 428 (87 percent).

Ways in which the Individual Mathematics Record is used:

To determine which skills to introduce, reinforce, reteach (66);
To check the skills a student has been taught and mastered (34);
To group students (33);
To identify students' areas of weakness (17).

Criticisms of the Individual Mathematics Record:

The Individual Mathematics Record is of no value (52);
Teachers maintain the record but do not use it (34);
It is used only if the student has a real problem in mathematics (7);
It is a waste of time and should be eliminated (7).

## E. HOW ARE MICROCOMPUTERS BEING USED IN MATHEMATICS IN ELEMENTARY AND SECONDARY SCHOOLS?

Teachers and school administrators were asked if microcomputers were available in the school and how they were being used in mathematics instruction. PA 32 ET 100 MJT 104 SHT 100

1. Microcomputers available?

| | TEACHERS | | | SCHOOL |
|---|---|---|---|---|
| | ELEM | M/JHS | SHS | ADMIN. |
| Yes | 57 | 92 | 86 | 80 |
| No | 43 | 8 | 14 | 20 |

Note: Those answering yes included in their responses those microcomputers that are located in the media center. Some teachers responded "yes" but that the computers were available on a limited basis, that they were not working, or that the number of computers available per student is very small.

Use of microcomputers in mathematics instruction

Drill, practice, review, and reinforcement (101);
To teach basic programming (53);
To teach computer mathematics (43);
To teach logical thinking skills (6);
To follow up direct instruction (5).

These data indicate that microcomputers are available to mathematics teachers in secondary schools more than in elementary; and that the primary uses are for drill, practice, review, and reinforcement, and to teach basic programming and computer mathematics.

## F. WHAT ARE THE RANGES IN TEACHERS' CLASS SIZES AND TEACHING LOADS? MD

Scheduled cards for secondary mathematics teachers were examined to gather the information reported below.

1. Size of secondary mathematics classes

Percentage of mathematics classes in each size category

| Class size | SCHOOL LEVEL MIDDLE | JUNIOR | SENIOR |
|---|---|---|---|
| 5-10 students | 1 | 0 | 3 |
| 11-15 students | 5 | 6 | 4 |
| 16-20 students | 14 | 14 | 14 |
| 21-25 students | 22 | 25 | 27 |
| 26-30 students | 30 | 36 | 29 |
| 31-35 students | 23 | 17 | 21 |
| 36-40 students | 2 | 2 | 3 |
| Mean class size | 26.1 | 25.6 | 25.4 |
| Range of class sizes | 9-38 | 11-39 | 5-40 |

2. Number of classes math teachers teach daily

The number of classes each full-time mathematics teacher was assigned for the fall 1984 was tabulated (mathematics department chairpersons and part-time teachers are not included in this tally).

| Number of Classes | SCHOOL LEVEL MIDDLE | JUNIOR | SENIOR |
|---|---|---|---|
| 4 | 2 | 0 | 2 |
| 5 | 98 | 100 | 98 |

3. Number of different courses taught by math teachers

The number of different courses taught by full-time mathematics teachers was tabulated and is reported below. Mathematics department chairpersons are not included in this table.

Number of Different Courses Taught
By Secondary Math Teachers

| Number of Different Math Courses Taught | SCHOOL LEVEL MIDDLE | JUNIOR | SENIOR |
|---|---|---|---|
| 1 | 32 | 11 | 3 |
| 2 | 45 | 51 | 24 |
| 3 | 23 | 37 | 60 |
| 4 | 0 | 0 | 3 |

These data suggest that:

a. More than ninety percent of the mathematics classes in secondary schools range in size from 16 to 35 students. The range in sizes of classes is fairly consistent in middle, junior high, and senior high schools.

b. Virtually all full-time secondary teachers (excluding department chairpersons) teach five classes daily.

c. Teachers must prepare to teach two to three different mathematics courses daily. Most middle school math teachers prepare for one or two separate courses daily (e.g., Unified Math 7 and 8 or Unified Math 8 and Algebra I); most junior high school teachers teach two or three different courses daily; and most senior high school teachers prepare to teach three different mathematics electives daily. (Note: these data are conservative and do not include the different preparations required to teach two and more levels of the same course, such as low or average ability

sections of Unified Math. This data was not obtainable from the teachers' schedule cards. Therefore, it is probable the number of individual teaching preparations required of each teacher is higher than the data represent.)

## G. HOW ARE TEACHERS USING THE MATHEMATICS CURRICULUM MATERIALS?

School administrators and mathematics teachers were asked a series of questions about what materials were used to plan for mathematics instruction, specific questions about the completeness and clarity of the mathematics curriculum questions, questions about the availability of curriculum materials, and questions about materials of instruction (textbooks, supplementary textbooks, and equipment).

1. What sources do teachers use in planning mathematics instruction?

PA 5
ET 8
MJT 8
SHT 9

Note: Respondents checked all of the following that were used. Therefore, percentages will total more than 100 percent.

| Materials used in planning mathematics instruction | TEACHERS ELEM | M/JHS | SHS | SCHOOL ADMIN. |
|---|---|---|---|---|
| Mathematics Goals and Objectives | 67 | 59 | 58 | 74 |
| Mathematics Scope and Sequence Chart | 69 | 49 | 18 | 81 |
| Unified Mathematics Booklets A, B, C or D | 36 | 35 | 20 | 56 |
| Mathematics Elective Course Guides | * | 18 | 33 | 25 |
| Mathematics Textbooks | 78 | 87 | 91 | 79 |
| Teacher's/students' backgrounds and interests | 55 | 68 | 63 | 54 |
| Other sources | 10 | 11 | 4 | 6 |

*Mathematics elective course guides are not used in elementary schools except for Introduction to Algebra.

Other sources that school administrators and mathematics teachers listed for planning mathematics instruction were varied and included sources such as the curriculum guides for gifted/talented students, supplementary materials, objectives and skill areas measured by the California Achievement and Maryland Functional Mathematics Tests, and workshop materials.

2. Mathematics curriculum materials

ET 21-27
MJT 21-28
SHT 15-21

Are the Unified Mathematics Booklets/course guides that you use complete?

| | TEACHERS ELEM | M/JHS | SHS |
|---|---|---|---|
| Yes | 72 | 64 | 50 |
| No | 5 | 16 | 23 |

Note: Specific comments about the completeness of curriculum materials will be included under the discussion of changes which should be made in the curriculum materials. This editorial change will eliminate redundancy in information while including all teacher's comments about the curriculum materials.

Are the Unified Mathematics Booklets/course guides that you use clear?

| | TEACHERS ELEM | M/JHS | SHS |
|---|---|---|---|
| Yes | 71 | 69 | 66 |
| No | 11 | 20 | 13 |

Are the basic materials of instruction listed in the Unified Mathematics Booklets/course guides you use appropriate for the activities you teach?

| | TEACHERS | | |
|---|---|---|---|
| | ELEM | M/JHS | SHS |
| Yes | 70 | 74 | 72 |
| No | 8 | 10 | 7 |

Are Unified Mathematics Booklets/course guides available to you in sufficient supply?

| | TEACHERS | | |
|---|---|---|---|
| | ELEM | M/JHS | SHS |
| Yes | 80 | 76 | 61 |
| No | 20 | 25 | 39 |

Would you like to have a curriculum guide for each grade level you teach?

| | TEACHERS | | |
|---|---|---|---|
| | ELEM | M/JHS | SHS |
| Yes | 75 | 82 | * |
| No | 18 | 15 | |

*Note: This question was inappropriate for senior high school teachers and was not included on their survey.

How easy or difficult is it for you to teach mathematics using the Unified Mathematics Booklets/course guides?

| | TEACHERS | | |
|---|---|---|---|
| | ELEM | M/JHS | SHS |
| Easy | 19 | 35 | 20 |
| Neither easy nor difficult | 69 | 55 | 70 |
| Difficult | 12 | 10 | 10 |

Are the activities suggested in the elective course guides you use realistic in terms of what you can accomplish in classroom?

| | TEACHERS | | |
|---|---|---|---|
| | ELEM | M/JHS | SHS |
| Yes | * | 56 | 48 |
| No | | 29 | 30 |

*Inappropriate question for elementary teachers.

Should the Unified Mathematic Booklets/course guides be changed in any way to make them easier to use?

| | TEACHERS | | |
|---|---|---|---|
| | ELEM | M/JHS | SHS |
| Yes | 21 | 26 | 35 |
| No | 45 | 43 | 65 |

Summarized below are all comments given five or more times about the curriculum materials, both Unified Mathematics Booklets and individual course guides, and suggestions for making them easier to use.

There is not enough time to teach, review, and expand all of the activities listed in the curriculum materials, teachers do not get beyond the basic content (16);
The curriculum materials need to be simplified and updated (13);
Rewrite the Unified Math booklets for individual grades in the same order as the Scope and Sequence (12);
The curriculum materials are unclear, wordy, too vague, and too general (11);
The materials of instruction listed in the curriculum materials are not available and/or need to be updated (6).

3. Mathematics materials of instruction

PA 21
ET 28-34
MJT 29-32
SHT 22-25

a. Textbooks. Do the textbooks used in the school correlate with the county mathematics curriculum?

| | TEACHERS | | |
|---|---|---|---|
| | ELEM | M/JHS | SHS |
| Yes | 91 | 95 | 90 |
| No | 9 | 5 | 10 |

Teachers who responded that the textbooks do no reflect the county mathematics curriculum gave the following as the primary reasons for their responses: Textbooks do not cover all of the concepts/skills in the Unified Mathematics Curriculum (e.g., sets, logic, computer skills, and/or problem solving) (19).

b. Manipulatives. Are the manipulatives you have adequate to teach at your grade level?

| | ELEM TEACHERS |
|---|---|
| Yes | 76 |
| No | 24 |

Elementary teachers who responded that the manipulatives are not adequate gave the following reasons:

Need more manipulatives, do not have enough of each type of manipulative, they are not available (rulers, thermometers, magnets, counters, manipulatives for fractions, place value, volume, metric) (76);
Manipulatives need to be updated (5).

c. Choosing textbooks. Who is responsible for choosing mathematics textbooks in elementary schools?

| | ELEM TEACHERS | PRINCIPALS |
|---|---|---|
| Principal | 11 | 0 |
| Teachers | 13 | 8 |
| Principal and teachers jointly | 74 | 88 |
| Other | 2 | 4 |

Are the Scope and Sequence Chart, Unified Math Booklets, and/or course guides useful when selecting the basic math textbooks used?

| | TEACHERS | | |
|---|---|---|---|
| | ELEM | M/JHS | SHS |
| Yes | 87 | 72 | 83 |
| No | 13 | 28 | 17 |

d. Availability of textbooks and equipment. Do you have a basic textbook for each grade/class/course you teach?

| | TEACHERS | | |
|---|---|---|---|
| | ELEM | M/JHS | SHS |
| Yes | 94 | 96 | 94 |
| No | 6 | 4 | 7 |

Do you have enough equipment to teach the mathematics curriculum?

| | TEACHERS | | |
|---|---|---|---|
| | ELEM | M/JHS | SHS |
| Yes | 73 | 80 | 70 |
| No | 27 | 20 | 30 |

Do you have enough supplementary textbooks for regrouping students?

| | ELEM TEACHERS |
|---|---|
| Yes | 61 |
| No | 40 |

These data suggest that:

(1) Textbooks are the materials that teachers most commonly use to plan math instruction. Most elementary teachers also use the Mathematics Scope and Sequence Chart, County Mathematics Goals and Objectives, and teacher's/students' background and interests to plan instruction, but to a lesser degree than textbooks. Secondary teachers use teacher's/students' background and interests and the County Mathematics Goals and Objectives for planning in addition to textbooks.

(2) Teachers responded that the Unified Mathematics Booklets and course guides are complete, clear, that the materials of instruction listed for the activities are appropriate, and that Unified Mathematics Booklets and elective course guides are available in sufficient supply. The course guides are less available and complete in senior high schools than in elementary schools.

(3) Although a higher percentage of teachers report that it is easy to teach mathematics using the Unified Math Booklets/elective course guides than report that it is difficult, most teachers take a middle position and report that it is neither easy nor difficult. Secondary teachers are also divided on the issue of whether the activities suggested in the elective course guides are realistic; although more report that the activities are realistic, the difference is not as large as on other questions. Finally, although most teachers responded that the Unified Math Booklets/elective course guides should not be changed to make them easier to use or that they did not know if changes were needed, one-fifth to one-third of teachers responded that changes are needed in the curriculum materials. The most frequently recommended changes were for updating materials to correspond to the format for elective courses and for writing Unified Math Booklets for each grade level.

(4) On questions about mathematics textbooks, a number of trends appear in the data. Textbooks used in schools correspond to the County mathematics curriculum. A basic textbook is available for each grade/class taught. Most teachers report that they have enough equipment to teach the mathematics curriculum, although 20 to 30 percent of the teachers responded that they need more instructional aides. Forty percent of the elementary teachers responded that they do not have enough supplementary textbooks for regrouping students.

(5) Teachers and principals generally agree that mathematics texts in elementary schools are selected jointly by the principal and teachers and that the Scope and Sequence Chart, Unified Mathematics Booklets, and elective course guides are useful when selecting the textbooks to be adopted.

## H. WHAT TYPES OF ASSISTANCE ARE NEEDED TO HELP INCREASE THE EFFECTIVENESS OF MATHEMATICS INSTRUCTION?

This open-ended question was asked of school administrators and teachers. Their suggestions are summarized below in order of frequency. All responses given five or more times are listed.

PA 33
ET 101
MJT 105
SHT 101

Staff Development and Teacher Inservice:

- More inservice programs and workshops (suggested topics were teaching methods, make it and take it, math literacy, short and long term planning, techniques to teach concepts and applications, kindergarten level math, fact skills, independent practice activities, upgrading teaching skills, early childhood education, Gifted/Talented Programs, problem solving techniques, master teaching, functional math skills, and teaching unmotivated students) (101);
- More demonstration lessons (9);
- Helping teachers to upgrade their teaching skills (9).

Staffing:

- More staff for individualized learning, more aides or parent volunteers to work with groups, computer aids, clerical work (56);
- More mathematics resource help, more effective resource help, resource teachers assigned to schools (45);
- Smaller classes, fewer students (26);
- Certified math teachers teaching math classes, more departmentalization in elementary school (7);
- More communication with other mathematics teachers, administrators, counselors to share ideas, methods, and procedures for specific courses (5).

Microcomputers:

- More inservice on microcomputers, to decrease teachers' fears of microcomputers, to integrate microcomputers into the total instructional program, and to use computers in large classes (20);
- Additional or better computers (18);
- Additional and/or better software for computers (8).

Mathematics Instruction:

- Allocate more time to math instruction, more time to teach math (20);
- More planning time (14);
- Greater use of and more hands on materials to get out of total textbook orientations (11);
- Help in grouping (flexible grouping, grouping homogeneously, grouping heterogeneously) (9);
- Assistance in providing for individual differences (7).

Mathematics Curriculum/Content:

- A guide which clearly states what is to be taught in Unified Math at each grade level (12);
- A better structured and organized County mathematics curriculum and course outlines (7);
- Improve instruction of functional mathematics skills (5);
- Revise the Unified Math Booklets - describe each objective with an example as well as a verbal description, give a reference for each objective, use format of curriculum guides listing objectives, content, activities and reference (5).

Materials of Instruction:

More and up-to-date textbooks, materials, math kits, manipulatives, workbooks, visual aids, games, reinforcement activities, films, and/or filmstrips (98);
Develop enrichment activities materials and/or supplemental programs for (advanced) students (8);
Up-to-date texts that correlate with the Scope and Sequence Chart, cover all concepts in unified math, and present the same concept in various formats (8);
Manipulatives for use in elementary instruction (6);
Provide a variety of materials, activities, and stations adaptable to all learners within a classroom (different ability levels) (6);
Packets of ideas for implementing mathematics units (similar to Gifted/Talented Materials), more games and fun activities for students (5);
New mathematics textbooks, a textbook that provides skills in sequence (5).

Other Comments/Suggestions:

No assistance is needed, good work is being done (110);
School-wide evaluation and constructive criticism by a knowledgeable outside team, for the Coordinator of Mathematics to conduct a needs assessment in this school with the teachers of the mathematics department (5).

## I. ADDITIONAL COMMENTS MADE BY THE STAFF ABOUT THE MATHEMATICS PROGRAM

PA 49
GC 42
ET 111
MJT 117
SHT 109

A final survey item asked staff members to comment on anything else they would like to share about the Mathematics Program that they hadn't previously written. These comments are tallied and summarized below. They are classified by positive comments, negative comments, suggested changes, and other comments. Under each category numbers in parentheses represent the number of staff members making each type of comment.

1. Positive comments:

The Countywide Mathematics Program is an excellent, effective one; it is comprehensive and well written; students interested in math have an excellent preparation for college (11).

2. Negative comments:

Twenty-four negative comments were made on a variety of topics which included instruction, courses available to students, the mathematics staff, students' failure rate, mathematics credit requirements, the curriculum, communication with parents, test-taking skills, the Individual Mathematics Record, workshops, and students with special needs. None of the comments were made more than four times and are also reflected elsewhere in the evaluation report.

3. Recommendations:

Eliminate Introduction to Algebra in grade 6 and Algebra I in grade 7 (suggestions: begin Algebra I in grade 8, or teach Unified Math 7 in grade 7, or offer Algebra I, Part I in grade 7 and Part II in grade 8, or offer Introduction to Algebra only to Gifted/Talented 7th grade students) (7);
Need more careful screening of 7th grade students. Many "nice kids" are placed in highly able sections of the gifted program who do not have the true math ability, raise the criteria for placement (7);
The remaining recommendations were in the areas of course sequences, grouping and placement of students, the mathematics curriculum and textbooks, class size, implementing the Unified Mathematics Curriculum, courses offered, functional mathematics, curriculum materials, and microcomputers. These recommendations were made by fewer than five respondents and are reflected in responses made to the individual questions and topics addressed throughout this evaluation report.

SUMMARY. The major findings related to mathematics instruction are summarized below. For more detail about any of the summarized findings, the reader will wish to consult the individual evaluation question and related data presented and discussed in greater detail in the body of this section of the evaluation report.

1. The County mathematics program is implemented to an adequate degree by at least 94 percent of the teachers and administrators surveyed. Teachers also report that they are both comfortable teaching the County mathematics curriculum and are prepared to teach it. The amount of time allocated daily for mathematics instruction from kindergarten through senior high school is in line with suggested guidelines.

2. Teachers are ensuring that the articulation built into the mathematics curriculum, both in Unified Mathematics and in the secondary elective courses, is reflected in instruction. More than 80 percent of the teachers report that they know the math skills and content which immediately precede and follow the grades/courses which they are currently teaching.

3. Teachers generally assign fifteen to 45 minutes of mathematics homework. The amount of homework increases from elementary to senior high school. Students' response to the homework issue is more extreme. More students report spending both less and more time on their mathematics homework than mathematics teachers estimate that it will take them to complete it.

4. A series of questions about the mathematics program in elementary schools reveals that elementary staff perceive that mathematics instruction in kindergarten has a positive influence on the total elementary school mathematics curriculum; about one-third of the elementary schools are departmentalized for mathematics instruction; teachers' and principals' reactions to math instruction in combination classes is mixed; and, although most administrators did not know if sixth grade mathematics instruction in elementary and middle schools was comparable, those who indicated that the instruction was not comparable reported that instruction was better in the middle schools than in elementary.

5. Mathematics teachers in Anne Arundel County Schools have eleven years of teaching experience on the average. Virtually all secondary teachers hold the appropriate certification for the level at which they are teaching; however, not all secondary mathematics teachers are specifically certified in mathematics. In addition the number of mathematics teachers who are resigning to take positions in fields other than teaching may be higher in mathematics that in other content area fields and may be increasing.

6. The most frequent types of instructional assistance that mathematics teachers receive are working with another math teacher or the department chairperson, County workshops, using the County mathematics curriculum, working with Coordinator of Mathematics and resource teachers, and using professional journals. These types of assistance were judged to be helpful. Other types of inservice programs available to mathematics and other teachers are the mathematics certification and mathematics upgrade programs, and conferences, journals, and publications of professional organizations. Currently about ten percent of the mathematics teachers and one-third of the principals would like more inservice opportunities made available to teachers.

7. Teachers use a variety of instructional and grouping strategies during their daily instruction. Lectures, discussions, and teacher demonstrations appear to be the most commonly and frequently used. Differences are apparent in secondary and elementary schools with respect to the use of written work, drill, learning stations, simulations, games, discovery learning, inquiry, and problem solving. Teachers use a variety of grouping techniques during class instruction ranging from total class to individual attention. Secondary teachers use total class presentations and discussions more frequently than elementary teachers and elementary teachers use grouping students into two or more groups for instruction more frequently than do secondary teachers.

8. Formal and informal assessment data and teacher recommendations are the primary types of information used to assign students to sections/courses for math instruction. Teachers appear to check student placements to insure that they are accurate and report that placements can be changed if necessary at times other than the end of a semester. Teachers use a variety of information to determine a students' instructional needs at the beginning of a course or school year. These data may include cumulative records, norm-referenced test results and tests in textbooks, as well as informal inventories, assessments, and teacher made tests. However, teachers rely heavily on teacher-made tests to assess mastery at the end of instruction.

9. While teachers are maintaining the Individualized Mathematics Record, they do not appear to be using it for instruction.

10. More than one-half of the teachers surveyed report that a microcomputer is available for use in mathematics instruction. Availability is higher in secondary than in elementary schools. Uses of microcomputers in mathematics include drill, practice, review, reinforcement, teaching basic programming, and teaching computer mathematics.

11. More than ninety percent of the mathematics classes range in size from 16 to 35 students. Mathematics teachers generally teach five classes per day and have at least two to three separate preparations daily in mathematics.

12. Teachers do most of their planning for mathematics instruction from the mathematics textbooks they use. Other sources used for planning include the mathematics scope and sequence chart, Unified Mathematics booklets, County goals and objectives, and teacher's and students' backgrounds and interests.

13. Teachers report that the Unified Mathematics Booklets and mathematics elective course guides are complete, clear, contain appropriate materials of instruction, and are available in sufficient supply. Course guides may be less available in senior high schools than in elementary schools.

14. Teachers generally responded that the Unified Mathematics Booklets and elective course guides do not need to be revised or changed or did not know if revisions were necessary. However, one in five teachers did suggest some specific changes to be made. The changes most frequently mentioned were to update the materials and to write Unified Mathematics Booklets for each grade level.

15. Teachers report that the textbooks they are using correspond to the County curriculum and are available in sufficient quantities. However, teachers do indicate a need for more instructional aids (such as manipulatives) and for more supplementary textbooks in elementary schools.

## IV. THE RESPONSES OF MATHEMATICS CONSULTANTS

INTRODUCTION. In order to obtain information from experts in mathematics instruction and the mathematics curriculum outside the school system, five specialists were contracted to answer a series of questions about Anne Arundel County Schools' Mathematics Curriculum. The evaluation questions addressed by the consultants are found as Appendix A. A summary of the consultants' individual reports is presented intact as received below. Copies of the individual consultant's reports are available in the Research Office.

### SUMMARY OF THE CONSULTANTS' REPORTS SUBMITTED FOR THE MATHEMATICS PROGRAM EVALUATION CONDUCTED BY THE RESEARCH OFFICE OF THE ANNE ARUNDEL COUNTY SCHOOLS.

Submitted by: Audrey V. Buffington, teacher, author, and consultant, Wayland Public Schools, Wayland, Massachusetts, January, 1985.

The following is a summary of the reports from five consultants to the Mathematics Program Evaluation coordinated by the Research Department of the Anne Arundel County Schools under the direction of Dr. Timothy R. Dangel. The consultants were:

Ms. Audrey Buffington, Teacher, Author, Consultant, Wayland (MA) High School
Dr. James Fey, Professor, Curriculum, Instruction, and Mathematics, University of Maryland
Dr. Thomas Rowan, Coordinator of Elementary Mathematics, Montgomery County Public Schools
Dr. Leon Sagan, Professor of Mathematics, Anne Arundel Community College
Dr. Max Sobel, Professor of Mathematics, Montclair (NJ) State College

In addition to the written summaries, four of the five consultants (Dr. Sobel could not be present) met for a one-day session with Dr. Henry Walbesser, University of Maryland, Baltimore County, to discuss their written reports.

This summary is presented in two sections: one, answers to evaluation questions sent to each consultant incorporating perceived strengths, weaknesses, and recommendations; and, two, a consolidated list of recommendations for your consideration. Some statements included in the summary are lifted from or are paraphrases of those in the consultants' reports.

It is important to say at the outset that the consultants were favorably impressed by the quantity and quality of the curriculum materials provided for the teachers of mathematics in the Anne Arundel County Schools. Always, a main concern, of course, is whether what is written is what is "delivered" in the classroom. The weaknesses identified were primarily related to the Unified Math guides for K-8. It was a great relief to learn that they are presently being rewritten.

The school system is to be commended for conducting such a comprehensive review of its K-12 math program. This action reflects a dedication to and desire for the best math program the system can provide.

#### A. MATHEMATICS CURRICULUM

1. Current Trends - curriculum and learning and instruction

Significant current trends include increased attention to problem-solving skills and thinking skills at all grade levels; applications; the use of technology (calculator and computer); and, perhaps, to a lesser degree, although of great importance, statistical concepts, probability, and mental arithmetic.

In comparison to what is provided by other systems and in many available materials, problem solving is treated adequately. The logic booklets are valuable in teaching thinking skills. There is concern over the fact that the problem-solving strategies are provided for gifted and talented students only.

As the Unified Program is being rewritten, it is recommended that more objectives related to technology be included, that those objectives left over from "New Math" (early numeration systems, modular systems, sets and logic, etc.) be deleted, and that all K-8 objectives be reviewed as to the appropriate level of introduction and mastery (there seems to be a growing tendency to introduce skills and concepts at an earlier age than before.)

The secondary program and the gifted and talented program are more current and comprehensive than the elementary one with the exceptions that problem solving and statistics may not be receiving appropriate emphasis in the curriculum for all students. The program most probably prepares students for current college programs but a review needs to be planned to examine the program in light of change that will most certainly be brought about by the computer.

The organization of the basic program into a unified sequence incorporating a spiral approach is in accord with current research. The recommended texts, however, do not seem to support this approach. (What effect does this conflict have on instruction in the classroom?) There is, also, concern that a program defined by a list of behavioral objectives; (this approach is undergoing substantial criticism) often leads to a fragmented program giving students few broad connections and a non-coherent view of math.

2. Cognition Development

The sequence of topics in the elementary program seems reasonable from the cognitive development point of view. The offering of algebra in grade 7, however, seems questionable. This vertical acceleration ignores the possibility of providing capable students with useful enrichment topics.

3. Students' Diverse Needs and Characteristics

There is a wide variety of offerings available for average and above-average students, with a clear distinction between programs for gifted students and others. It is not quite clear, however, what provisions are made for the slow learner.

The NCTM (National Council for Teachers of Mathematics) and many state agencies are suggesting that at least three years of math be required in grades 9-12 to insure functional competency for those who graduate into the technological world of the 1990's. This should be considered in Anne Arundel County with the thought of incorporating the computer into all programs, especially those for the less able student. This could provide enough interesting opportunities for three years of math.

4. Sequence and Balance Among Content, Skills, and Learning Outcomes

There seems to be an appropriate sequence of skills and content with adequate reinforcement and without unnecessary duplication. Any inappropriate emphasis on desirable levels of learning outcomes might be remedied by adding more problem-solving and higher level thinking skill objectives at <u>all</u> grade levels. The curriculum may be a bit heavy on "manipulative" skills at some levels.

Although there are advantages to each sequence, it is generally agreed that as long as three year-long courses are provided, the sequence Algebra I - Geometry - Algebra II is as good as any.

The historical development of math is probably handled well by only a few informed teachers. Classroom resources addressing this topic, as well as the topics of math as an art and math as a language, could be very helpful to teachers.

Concern was expressed regarding the offering of Algebra in grade 7. (Although 6th graders may demonstrate a high level of performance on skills, their depth of conceptual understanding and their problem-solving ability could both be increased by a challenging unified math course in grade 7.) If this practice is discontinued, the problem of what to do with 6th graders who are unsuccessful in Introduction to Algebra will not arise. Otherwise, among the current offerings, Advanced Unified Math would probably be the best course for those students.

The advisability of offering a course in geometry in grade 8 is questionable. Only the most gifted 8th graders have the math maturity required for abstract deductive thinking.

5. Instructional Time

Generally, the amount of instructional time allotted daily to math in the instructional guides seems appropriate. A more vital concern expressed is how that time is used -- seatwork? teacher-directed activities?

6. Organization of Unified Mathematics in High School

There is no consensus on the best program -- unified or content-descriptive -- for low to average ability high school students. There is agreement that applications of skills and concepts, using the computer and/or calculator for skills, would be advisable.

7. Computer Education

Computers are important in their own right in today's society. Content and skills which have to do with the computer per se should be a part of computer science. This in no way would lessen the impact of the computer on the teaching and learning of math.

8. Curriculum Objectives/Course Outlines

The more recent guides are much clearer and, thus, it is believed, easier for teachers to use. The suggested activities and resources should be helpful. In rewriting the Unified Math guides, if the same format is used as with the high school guides, the K-8 guides should be very useful, too. As mentioned before, however, it is not so much what is in the guide as it is how many of the activities and resources are actually used in the classroom.

B. SELECTION FOR GIFTED/TALENTED PROGRAM

If a gifted/talented program is to be offered, your selection procedures and criteria seem as appropriate as any. It is evident that much thought has gone into the identification of these students. Some reservations were expressed, however, about the advisability of offering such a program (Algebra I in grade seven). (What are the results? Are they positive? Are there activities important for all students that are being provided only to gifted and talented programs?)

C. CURRICULUM/TEST CORRESPONDENCE

The tests used probably assess as well as any the core objectives of your program. Teachers need to be instructed in creating tests that assess other mastery-level objectives as well as in using a wider range of evaluative measures.

D. STAFF DEVELOPMENT

A good selection of inservice opportunities is provided. The county is to be commended for the commitment given to the Math Certification/Upgrade Program.

The courses offered, however, seem to emphasize content while giving little attention to motivation and pedagogy. Learning how to incorporate statistics and problem solving into programs at all grade levels could be very important.

## MAJOR RECOMMENDATIONS

1. Update K-12 objectives to include problem-solving, statistics, and technology objectives for all students.

2. Review K-8 objectives for appropriate grade level placement for mastery.

3. Provide clearer guides, objectives, and resources for low-level students, K-12.

4. Review advisability of offering Algebra I to seventh graders and related offerings (Pre-Algebra in grade 6 and Geometry in grade 8).

5. Consider a 3-year math requirement for graduation.

6. In the rewriting of K-8 guides, use a format similar to the one used for high school guides incorporating activities and resources.

7. Create materials for teachers to assist them in incorporating historical objectives and in treating math as an art and as a language.

8. Extend inservice opportunities for teachers to include motivation and pedagogy as well as content.

9. Continue encouraging students to enroll in Advanced Placement Calculus and assuming the cost of test administration.

## SUMMARY, OBSERVATIONS, AND RECOMMENDATIONS

### I. SUMMARY AND OBSERVATIONS

This evaluation of the Mathematics Program was designed to answer a set of broad research questions. The questions relate to the mathematics curriculum, students' achievement in and attitudes toward mathematics, and mathematics instruction. The Results section of this report addressed these questions by integrating data provided by consultants; graduates of and students currently enrolled in the schools; administrators, guidance counselors, and mathematics teachers; test score patterns; and other data previously gathered.

Realizing that the responses given by the consultants, students, and the staff will vary based upon their particular experiences and vantage points, the following observations are offered to serve as a summary of the Mathematics Program Evaluation. More specific data on any observation can be found in the Results section of this report.

#### A. THE MATHEMATICS CURRICULUM

1. The curriculum reflects current trends in curriculum development and research particularly in its increased attention to problem solving skills and thinking skills at all grade levels; application; use of technology, statistical concepts, probability, and mental arithmetic; and the organization of the basic program into a unified sequence incorporating a spiral approach. The secondary mathematics curriculum and gifted/talented program are more current than the elementary curriculum. Three areas where the curriculum may not be current are stressing problem-solving and statistics with gifted/talented students only, and continuing to include in the program some objectives left over from the "New Math". Teachers believe that graphic operations, geometry, sets and logic, and measurement need greater emphasis in the curriculum, in addition to probability, statistics, and problem-solving.

2. The curriculum appears to match the cognitive development of students at all levels, kindergarten through grade twelve, with the exception of Algebra I in grade seven and Geometry in grade eight. Mathematics teachers and consultants believe that, except for the most gifted students, students in grades seven and eight lack the maturity and cognitive development required for Algebra and Fused Geometry. Feelings of students in the program do not reflect those of the staff. Students who take Algebra I in grade seven report that they are satisfied with their mathematics education and would enroll in Algebra I again. Over 80 percent of the students who complete Algebra I in grade seven earn grades of C or better in Algebra II and Fused Geometry.

3. The curriculum appears to meet the diverse needs and interests of students. There is a wide variety of offerings available for average and above-average students with a clear distinction between programs for gifted students and others. If any area remains unclear or undefined, it is what provisions are made for the slow learner, particularly at the secondary level.

4. The consultants report that there seems to be an appropriate sequence of skills and content with adequate reinforcement and without unnecessary duplication. Secondary teachers identified some specific areas in which they believe there may be duplication.

5. The amount of instructional time allotted daily to math in the instructional guides seems appropriate. A more vital concern is how that time is used.

6. There is no consensus on the best mathematics program for high school--unified or content-descriptive--for low to average ability students. There is agreement that mathematics instruction for these students should include applications of skills and concepts.

7. The more recent course guides are much clearer and, probably, easier for teachers to use than the older ones. As new guides are written and existing ones are revised they should be patterned after the current guidelines. This is especially true of the elementary guides.

8. Selection procedures and criteria for the gifted/talented program seem to be appropriate. Most students are selected to participate in gifted/talented mathematics programs separately from their selection to participate in other content area gifted/talented programs. Information used to select students includes ability, mathematics achievement, teacher recommendation, and classroom performance. Teachers report that the selection criteria appear to correlate with a high mathematics aptitude.

9. There appear to be more differences between the gifted/talented mathematics program and the regular mathematics program in secondary schools than in elementary. The gifted/talented mathematics program in grades four and five is determined by the guidelines for highly capable students, the program in grade six is Introduction to Algebra, in grade eight it is Fused Geometry, the high school program in grades 9 through 12 consists of higher level mathematics electives, especially AP Calculus.

10. The tests used to assess students' achievement (California Achievement Test and Maryland Functional Mathematics Test) assess the core objectives of the mathematics program as well as any tests available. The Coordinator of Mathematics has analyzed both tests and has shared with mathematics teachers and principals the areas where skills are assessed by the test before they appear in the County mathematics scope and sequence.

11. The staff development activities provide teachers with a good selection of inservice opportunities. The Mathematics Certification/Upgrade Program is especially to be commended. Math workshops may be too heavy on content with too little emphasis on motivation and pedagogy.

12. The majority of teachers and guidance counselors believe that the increase in required mathematics credits for graduation from two to three is the right decision.

B. THE STUDENT--PERFORMANCE, ATTITUDES, AND LATER SUCCESS

1. Graduates of the Anne Arundel County Public Schools are satisfied with their mathematics education and the number and variety of math courses available to them. Most graduates award the mathematics program and teaching a grade of B or higher.

2. Graduates (70 to 86 percent) report that the mathematics courses they took in high school prepared them for any additional math courses that they have taken since graduation and/or for the mathematics knowledge and skills required on their jobs. About half of the graduates report that they have taken additional mathematics in high school. Almost eight out of every ten graduates reports that his/her job requires a knowledge of mathematics and math skills, at least occasionally.

3. Students' career decisions and awareness of the mathematics required for them are made over the entire span of secondary school and increase with grade level. Generally students appear to know the math credit requirements for graduation. About one-half of the students currently enrolled in high school plan to earn at least four credits in mathematics.

4. County achievement in mathematics has risen on the Iowa Tests of Basic Skills and California Achievement Test over the last ten years at each grade tested and is currently above the national norm. The percentage of ninth grade students passing the Maryland Functional Mathematics Test on their first attempt has increased from 42 percent in 1982 to 67 percent this school year. County performance on the mathematics portion of the Scholastic Aptitude Test has been variable over the last ten years. Currently the score is above the state and at the national average and appears to be increasing. Since the Board of Education began paying for the test administration, the number of students earning college credit in Advanced Placement Calculus has increased five times.

5. The majority of students who begin Introduction to Algebra in grade seven continue through Fused Geometry. More than 90 percent of the middle school students who complete Introduction to Algebra in grade six enroll in Algebra I in grade seven; more than 90 percent continue on in Fused Geometry. Approximately 90 percent of the students enrolled in Introduction to Algebra and Algebra I earn a final grade of C or better. A larger proportion of white and Asian students and a smaller percentage of black students are enrolled in Introduction to Algebra, Algebra I, and Fused Geometry in grades six through eight than are represented in the total school population. A larger percentage of males takes Algebra I in grade seven than females.

6. The majority of students who enroll in Algebra I in grade seven are satisfied with their mathematics education and would do it again. Eighty to 98 percent of students who earn a C or better in Algebra I in grade seven earn a final grade within one letter grade in Algebra II and Fused Geometry. Failures in Introduction to Algebra and Algebra I are primarily due to poor work/study habits, poor motivation and persistence, immaturity, and poor math background.

7. Staff perceptions on the issue of offering Introduction to Algebra in grade six and Algebra I in grade seven are mixed. Two-thirds of the teachers report that Introduction to Algebra does not adequately prepare students for Algebra I; more than 80 percent of the elementary teachers report that they do not have enough time to complete the outline for Introduction to Algebra in grade six, and staff is mixed in its opinion whether Algebra I should be offered to students in grade seven to the extent that it is now offered.

8. An examination of the secondary school mathematics electives revealed that a higher percentage of males, Asian, and white students and a lower percentage of black and female students are enrolled in the academic level elective math courses than are represented in the total school population. It also appears that students are enrolling in math courses which match their abilities and achievement levels. Ability and achievement levels are higher for academic courses than for courses designed for non-academic students, as would be expected unless highly able students are enrolling in less demanding courses in order to obtain a higher grade point average. This does not appear to be occurring to any large degree.

9. Most graduates from the Anne Arundel County Public Schools between 1978 and 1982 earned more than the two mathematics credits required for graduation. The number of mathematics credits earned over a five year period appears to be on the increase with black students showing the greatest increase during this period.

10. The highest student failure rate in mathematics occurs in courses such as Unified Mathematics and Applied Math, while the lowest percentage of failures occurs in the highest level academic courses such as Probability and Statistics, Calculus, and Elementary Functions.

11. Principals, guidance counselors, and teachers report that students who are successful in high school academic mathematics courses have good study habits and perseverance, and are highly motivated, bright, mature, and self-disciplined. Conversely, students who experience failure in high school mathematics courses have poor study habits, a poor background in math, little interest in math, and low motivation, self-discipline, and attendance.

12. The majority of vocational students, including those who receive an applied mathematics credit after completing two years of a trade, appear to be satisfied with their mathematics education and do not differ from non-vocational students in this regard. However, they are less satisfied with the number and variety of mathematics courses available to them than non-vocational students and tend to give the mathematics program slightly lower grades.

13. The issue of whether or not to award applied math credit to vocational students is not resolved by the data. Both vocational students who have and who have not received an applied math credit express satisfaction with the mathematics education they have received or are receiving. Students and teachers are divided on the issue; about half believe that applied math credits should be awarded and about half believe that they showed not. School administrators believe that they should be awarded. In addition it can be projected from that data that vocational students who earn an applied math credit have similar math experiences to students who have earned their two credits by completing mathematics program electives, but who tend to be less successful in mathematics.

C. MATHEMATICS INSTRUCTION

1. The County Mathematics Program is implemented to an adequate degree by at least 94 percent of the teachers and administrators surveyed. Teachers also report that they are both comfortable teaching the mathematics curriculum and are prepared to teach it. The amount of time allocated daily for mathematics instruction from kindergarten through senior high school is in line with suggested guidelines.

2. Teachers are ensuring that the articulation built into the mathematics curriculum, both in unified mathematics and in the secondary elective courses, is reflected in instruction. More than 80 percent of the teachers report that they know the math skills and content which immediately precede and follow the grades/courses which they are currently teaching.

3. Teachers generally assign fifteen to 45 minutes of mathematics homework each night. The amount of homework increases from elementary to senior high school. Students' responses to the homework issue is more diverse. More students report spending both less and more time on their mathematics homework than teachers estimate it will take them to complete it.

4. A series of questions about the organization of the mathematics program in elementary schools reveals that elementary staff perceive that mathematics instruction in kindergarten has a positive influence on the total elementary school mathematics curriculum; about one-third of the elementary schools are departmentalized for mathematics instruction; teachers' and principals' reactions to math instruction in combination classes is mixed; and, although most administrators did not know if sixth grade mathematics instruction in elementary and middle schools is comparable, those who indicated that the instruction was not comparable reported that instruction was better in the middle schools than in elementary.

5. Mathematics teachers in Anne Arundel County have eleven years of teaching experience on the average. While all full-time secondary teachers with mathematics as their primary responsibility hold the appropriate certification for the level at which they are teaching, there are some part-time secondary mathematics teachers who are not specifically certified in mathematics. In addition, the number of mathematics teachers who are resigning to take positions in fields other than teaching may be higher in mathematics than in other content area fields and may be increasing.

6. The most frequent types of instructional assistance that mathematics teachers receive are working with other math teachers or the department chairperson, county workshops, using the county mathematics curriculum, working with the Coordinator of Mathematics, resource teachers, and using professional journals. These types of assistance were also judged to be helpful. Other types of inservice programs available to mathematics and other teachers are the Mathematics Certification and Upgrade Program, conferences, journals, and publications of professional organizations.

Currently about ten percent of the mathematics teachers and one-third of the principals would like more inservice opportunities made available to teachers. The types of inservice programs teachers would most like to receive deal with teaching methods and strategies, computer literacy, and making and using manipulative in the classroom.

7. Teachers use a variety of instructional and grouping strategies during their daily instruction. Lectures, discussions, and teacher demonstrations appear to be the most commonly and frequently used. Differences are apparent in elementary and secondary schools with respect to the use of written work, drill, learning stations, simulations, games, discovery learning, inquiry, and problem solving. Teachers use a variety of grouping techniques during class instruction ranging from total class to individual instruction. Secondary teachers use total class presentations and discussions more frequently than do elementary teachers who use grouping students into two or more groups for instruction more frequently.

8. Formal and informal assessment data and teacher recommendations are the primary types of information used to assign students to sections/courses for math instruction. Teachers appear to check student placements to insure that they are accurate and report that placements can be changed if necessary at times other than the end of a semester. Teachers use a variety of information to determine a students' instructional needs at the beginning of a course or school year. These data may include cumulative records, norm-referenced test results and tests in textbooks, as well as informal inventories, assessments, and teacher-made tests. However, teachers rely heavily on teacher-made tests to assess mastery at the end of instruction.

9. While teachers are maintaining the Individualized Mathematics Record, they do not appear to be using it for instruction.

10. More than one-half of the teachers surveyed report that a microcomputer is available for use in mathematics instruction. Availability is higher in secondary than in elementary schools. Uses of microcomputers in mathematics include drill, practice, review, reinforcement, teaching basic programming, and teaching computer mathematics.

11. More than ninety percent of the mathematics classes range in size from 16 to 35 students. Mathematics teachers generally teach five classes per day and have at least two to three separate preparations daily in mathematics.

12. Teachers do most of their planning for mathematics instruction from the mathematics textbooks they use. Other sources used for planning include the mathematics scope and sequence chart, unified mathematics booklets, secondary elective course guides, county goals and objectives, and teacher's and student's backgrounds and interests.

13. Teachers report that the unified mathematics booklets and mathematics elective course guides are complete, clear, contain appropriate materials of instruction, and are available in sufficient supply. Course guides may be less available in senior high schools than unified math booklets are in elementary schools.

14. Teachers generally responded that the unified mathematics booklets and elective course guides do not need to be revised or changed. However, one in five teachers did suggest some specific changes to be made. The changes most frequently mentioned were to update the materials and to write unified mathematics booklets for each grade level.

15. Teachers report that the textbooks they are using correspond to the county curriculum and are available in sufficient quantities. However, teachers do indicate a need for more instructional aides (rulers, thermometers, and other manipulatives) and for more supplementary textbooks in elementary schools.

## II. RECOMMENDATIONS

The following recommendations for changes and revisions in the Mathematics Program were offered by consultants, staff members (principals, guidance counselors, mathematics department chairpersons, and mathematics teachers), graduates and current students.

### A. CONSULTANTS

1. Update the kindergarten through grade twelve objectives to include problem-solving, statistics, and technology objectives for all students.

2. Revise the kindergarten through grade eight objectives for appropriate grade level placement for mastery.

3. Provide clearer guides, objectives, and resources for low level students, kindergarten through grade twelve.

4. Review the advisability of offering Algebra I to seventh graders and related offerings (Introduction to Algebra in grade six and Geometry in grade eight).

5. In the rewriting of the kindergarten through grade eight guidelines, use a format similar to the one used for high school course guides incorporating activities and resources.

6. Create materials for teachers to assist them in incorporating historical objectives and in treating math as an art and as a language.

7. Extend inservice opportunities for teachers to include motivation and pedagogy as well as content.

8. Continue to encourage students to enroll in Advanced Placement Calculus and to assume the costs of administering the test.

B. STAFF (Note: Numerals in parentheses indicate the number of times the recommendations were made. These recommendations are summarized from the 110 administrators, 63 guidance counselors, and 680 elementary, 114 middle/junior, and 93 senior high school teachers who returned surveys).

1. The Mathematics Curriculum

Revise the unified mathematics booklets and course guides: state clearly what is to be taught at each grade level; improve the structure and organization of the booklets and guides; describe each objective with an example as well as a verbal description, give a reference for each objective, use the format of the curriculum guides for the unified math booklets. (24)

Improve the instruction of functional mathematics skills. (5)

2. Materials of Instruction

Provide more textbooks and materials: additional and up-to-date textbooks that provide skills in a sequence, correlate with the scope and sequence, and cover all the unified mathematics concepts; additional materials, math kits, manipulatives, workbooks, visual aids, games, reinforcement activities, films, and filmstrips. (119)

Develop enrichment activities materials and supplemental activities for advanced students. (8)

Make available to teachers a variety of materials, activities, and stations adaptable to learners at different ability and achievement levels within a classroom. (6)

Develop packets of ideas for implementing mathematics units (similar to those developed for gifted/talented students), more games and fun activities for students. (5)

3. Mathematics Instruction

Allocate more time to mathematics instruction. (20)

Provide teachers more planning time. (14)

Make a greater use of hands on materials to get away from total textbook orientations. (11)

Provide teachers help in grouping students for instruction (flexible grouping, and grouping homogeneously and heterogeneously). (9)

4. Gifted/Talented Program

Eliminate Introduction to Algebra in grade six, Algebra I in grade seven, and Geometry in grade eight. Begin Algebra I in grade eight. (7)

Raise the criteria for placement in gifted/talented mathematics programs. Screen the seventh grade students for Algebra I more carefully. Many "nice kids" are placed in highly able sections or the gifted program who do not have the true mathematics ability. (7)

5. Staff Development and Teacher Inservice

Provide more inservice programs and workshops. Suggested topics were teaching methods, make it and take it workshops, math literacy, short and long term planning, techniques to teach concepts and application, kindergarten level mathematics, fact skills, independent practice activities, upgrading

teaching skills, early childhood education, gifted/talented programs, problem solving techniques, master teaching, functional math skills, and teaching unmotivated students. (101)

Provide more demonstration lessons for teachers. (9)

Help teachers to upgrade their teaching skills. (9)

6. Staffing

Provide more staff for individualized learning, more aides or parent volunteers to work with groups, computer aides, and clerical help. (56)

Provide more math teachers for smaller classes. (26)

Assign only certified mathematics teachers to teach math classes; use more departmentalization in elementary school mathematics. (7)

More communication is needed among mathematics teachers, administrators, and counselors to share ideas, methods, and specific instructional procedures. (5)

7. Microcomputers

Provide more inservice on microcomputers to decrease teachers' fears of microcomputers, to integrate microcomputers into the total instructional program, and to facilitate using microcomputers in large classes. (20)

Provide additional and/or better microcomputers. (8)

Provide additional and/or better software for microcomputers. (8)

C. STUDENTS (These recommendtions are summarized from the 584 current students, 311 graduates, and 330 students who took Aglebra I in grade seven who returned surveys.)

1. Offer more upper level/advanced mathematics courses, especially for the students who have completed calculus by grade eleven. (17)

2. Provide more computers, computer courses, and opportunities to work with the computer. (9)

3. Include more applications to everyday life in the mathematics content, such as how to handle personal finances. (8)

4. Refine the selection and placement procedures for the gifted/talented program. (7)

5. Require students to take more mathematics courses. (5)

6. Improve the quality of the teachers and the teaching; use more teacher evaluation; and hire the teachers with the best records and experience, not jut those that are most available. (5)

## III. DISCUSSION OF THE MODEL AND CONCLUDING OBSERVATIONS

The Office of Research was assigned the task of designing an evaluation of the Mathematics Program, collecting and analyzing the data, and preparing a final report. This responsibility is met with the completion of this report.

The model upon which this and previous evaluations have been based works well. The model has provided for a comprehensive examination of the curriculum and an opportunity for the staff involved with mathematics education to participate in both determining what questions to address as well as responding to specific evaluation questions. Simultaneously, the evaluation model minimized requests for information at the school level by using data stored on the Anne Arundel County data base and aggregating existing information wherever possible. The consultants as well as the audiences at national conferences on educational research have praised the comprehensiveness of the model and have commended the school system for embarking on evaluations of this scope and magnitude. It appears that few, if any, school systems engage in program evaluations as comprehensive as this one. While refinements in the model will undoubtedly occur each time an evaluation is undertaken, the model appears to be a sound method for guiding program evaluations.

The findings and recommendations made by consultants, principals, guidance counselors, department chairpersons, teachers, graduates, and current students largely speak for themselves. The reader of this report will note that the findings and recommendations exhibit both consistencies and contrasts. Consistency is illustrated by the fact that many observations made by consultants or the staff or students or in existing data are also

found in at least one other source. For example, note the emphasis of both consultants and teachers on revising the unified mathematics curriculum by grade level and using the format of the current course guides as the format for the revised guides. However, not every finding or recommendation is consistent with every other. There are some contrasts to be found in the data. Test scores may lead one to contradictory conclusions depending upon which data are examined. Consultants and teachers differ from students in their position regarding offering Algebra I to students in grade seven. The various individuals who contributed data by virtue of their backgrounds, responsibilities, and experiences will bring different focuses to the evaluation. For example, consultants tend to examine the curriculum in light of the state of the art, profession, and national trends. Teachers responded to the surveys from the vantage point of the reality of the classroom and offer suggestions which will increase their effectiveness as classroom teachers; and students are more likely to evaluate the program remembering the impact of specific mathematics teachers over program content. Each source, however, contributes its unique perspective to the total picture which emerges from the evaluation data.

Thus, the various observations and recommendations made by consultants, staff, and students will need to be examined and discussed by the various audiences who receive it. Any actions which are proposed to address the recommendations for the Mathematics Program should be made through the Mathematics Office following an ample time for the staff to study this report and to examine the recommendations.

## ANNE ARUNDEL COUNTY PUBLIC SCHOOLS

## MATHEMATICS PROGRAM EVALUATION

The following questions are to be addressed by each consultant as he/she examines the Anne Arundel County Public Schools' Mathematics Program curriculum materials. Specific materials to examine when answering questions are listed in the column to the right of the questions.

Materials to Use in Answering Questions

I. Mathematics Curriculum

Goals and Objectives for Mathematics,
Mathematics Scope and Sequence Chart,
Unified Mathematics Curriculum,
Mathematics Curriculum Materials for Highly Able, Gifted/Talented and Precocious Students,
Course Descriptions (Secondary Elective Mathematics Courses),
Mathematics Course Guides,
Course Outlines and Curriculum Guides,
Approved Basic Text List

A. Current Trends

1. Does the curriculum reflect current trends in mathematics curriculum development?

2. Does the curriculum reflect current research in learning and instruction with implications for mathematics education?

3. What parts of the mathematics curriculum need to be updated?

B. Cognitive Development

1. Does the mathematics curriculum match students' cognitive development at each age and grade level?

C. Students' Diverse Needs and Characteristics

1. Does the curriculum meet the diverse educational needs and characteristics of students at each grade level? Are the content appropriate and number of courses adequate to meet the diverse needs and characteristics of students?

2. Does the mathematics program for elementary gifted/talented students differ from the program for secondary gifted/talented students?

3. Does the mathematics program for gifted/talented students differ from the regular mathematics program?

4. Are the mathematics requirements for all students sufficient to guarantee mathematics literacy at graduation?

5. Does the curriculum place sufficient emphasis upon functional skills in mathematics?

D. Sequence and Balance Among Content, Skills, and Learning Outcomes

1. Is there a balance in the mathematics skills and content taught at each grade level or within each elective course?

2. Are the skills and content in the curriculum organized in a sequenced manner? Is the most appropriate sequence used?

3. Are the content and skills introduced at one grade level reinforced in subsequent grades and elective courses?

4. Is there any unnecessary duplication in mathematics content from grade to grade? If so, can it be reduced?

5. Are there topics omitted from early grades/courses which are assumed to have been learned in later grades/courses?

6. Does the curriculum give appropriate emphasis to all desirable levels of learning outcomes (e.g., knowledge, application, problem solving)?

7. Are there differences in the skills and content which comprise Level I Unified Mathematics 9 and 10?

8. What is the most appropriate sequence for Algebra I, Algebra II, and Geometry in middle school, junior high school, and senior high school?

9. Does the Mathematics Curriculum give appropriate emphasis to probability and statistics? the historical development of mathematics? mathematics as an art? number theory?

10. What should the instructional sequence be for students who are unsuccessful in Introduction to Algebra? Note: Fifth grade students who meet specific criteria are nominated to enroll in Introduction to Algebra in grade 6. Students who are successful in Introduction to Algebra may enroll in Algebra I in grade 7.

11. Should Algebra I be offered in grades 7 and 8? Should Algebra II and Fused Geometry be offered in grade 8?

12. What is the effect of mathematics instruction in kindergarten on the elementary school curriculum?

E. Instructional Time

1. How much instructional time should be allotted daily for mathematics instruction in kindergarten through grade 12?

2. Is the amount of time allotted to mathematics instruction balanced with the amount allotted to other content areas (reading, English language arts, social studies, science)?

Mathematics Instructional Time Materials

F. Organization of Unified Mathematics in High School

From your vantage point, what is the best organization for offering mathematics to low to average ability high school students, general or unified mathematics or a series of short, content descriptive semester-length courses (such as consumer math, career math, basic skills math, etc.)?

G. Computer Education

1. Where should computer education be placed in the curriculum, as part of mathematics or as part of computer science?

2. If computer education were placed under computer science, would that limit a student's exposure to computer mathematics?

H. Curriculum Objectives/Course Outlines

Unified Mathematics Curriculum,
Mathematics Course Guides, Course Outlines, and Curriculum Guides,
Approved Basic Text List

1. Are the curriculum guides and course outlines complete and clear?

2. Is it easy or difficult for teachers to teach mathematics using the County curriculum guides and course outlines?

3. Are the suggested activities in the course outlines realistic in terms of what can be done in individual classrooms?

4. Are the basic, supplementary, and resource materials of instruction listed in course outlines appropriate for the instructional activities?

5. Are the hands-on materials suggested for the primary grades appropriate?

II. Selection for Gifted/Talented Programs

Identification and Placement of Highly Able, Gifted/Talented and Precocious Students

From your vantage point as a mathematics educator:

1. Are the procedures for identifying and selecting students to participate in mathematics programs for gifted/talented students the most appropriate ones?

2. Are the criteria for identifying and selecting students to participate in mathematics programs for gifted/talented students the most appropriate ones?

3. Do the selection criteria for selecting students for gifted/talented mathematics programs correlate with high level aptitudes in mathematics?

III. Curriculum/Test Correspondence

Formal Standardized Test Objectives

Do the objectives assessed by formal tests used in the Anne Arundel County Public Schools reflect the objectives of the County mathematics curriculum?

IV. Staff Development

Staff Development Activities in Mathematics for Teachers

Are inservice opportunities sufficiently available to insure that teachers can implement the Mathematics Curriculum? If the answer is no, what revisions or additions to inservice workshops are necessary?

**ANNE ARUNDEL COUNTY PUBLIC SCHOOLS**

**MATHEMATICS PROGRAM EVALUATION**

**SURVEY OF STUDENTS**

Dear Student:

The Anne Arundel County Public School System is evaluating its Mathematics Program. One part of this evaluation involves asking students who are enrolled in the Anne Arundel County Public Schools to answer a series of questions about their experiences with the mathematics courses they are taking in grades 9 through 12. Your name has been selected at random from students who are enrolled in grades 9 through 12. Would you please take a little time to complete this survey. The answers you give to the survey questions will be used to help the Mathematics Program better meet the needs and interests of students like you. All the information which you give will be anonymous. Please return the completed survey within seven (7) days in the envelope which has been provided. Thank you.

**DIRECTIONS: Please answer the questions in this survey as they apply to your experiences in the Anne Arundel County Public Schools' Mathematics Program. Indicate your answers by marking an X in the space beside the most appropriate response to each question or by writing a comment when one is requested.**

Sex __M __F

What grade were you in during the past school year? _____

1. In which of the following programs are you enrolled in school?

   __ A. Academic
   __ B. Business Education
   __ C. Vocational Education
   __ D. General
   __ E. I don't know

2. Did you take any mathematics courses this past school year?

   __ A. Yes
   __ B. No

3. How well satisfied are you with the mathematics education you are receiving in the Anne Arundel County Public Schools?

   __ A. Satisfied
   __ B. Neither satisfied nor dissatisfied
   __ C. Dissatisfied (why?) _____
   _____

4. How well satisfied are you with the number and variety of mathematics courses offered in school?

   __ A. Satisfied
   __ B. Neither satisfied nor dissatisfied
   __ C. Dissatisfied (why?) _____
   _____

5. If you could give a grade to the mathematics program, what grade would you give?

   __ A
   __ B
   __ C
   __ D
   __ E

6. If you could give a grade to the mathematics teaching, what grade would you give?

   __ A
   __ B
   __ C
   __ D
   __ E

7. Have you made a decision about what type of career or employment opportunity you will pursue after high school?

   __ A. Yes (What type?) _____
   _____

   __ B. No (go to item 9)

8. Do you know what the mathematics requirements are for this type of employment or career?

   __ A. Yes
   __ B. No
   __ C. I don't know

9. How many mathematics credits are required for high school graduation?

   __ A. 1
   __ B. 2
   __ C. 3
   __ D. 4
   __ E. 5
   __ F. More than 5
   __ G. I don't know

10. How many mathematics credits do you plan to earn prior to graduation? (including credits earned through credit by examination)

    __ A. 1
    __ B. 2
    __ C. 3
    __ D. 4
    __ E. 5
    __ F. More than 5
    __ G. I don't know

11. If you plan to work toward a Certificate of Program Achievement, which certificate do you wish to receive?

__ A. Advanced Academic Certificate
__ B. Academic Certificate
__ C. Vocational Certificate
__ D. Specialized Certificate in Art, Music, or Physical Education and Health
__ E. No Certificate
__ F. I don't know

**ITEMS 12-16: How often do you do each of the following in your mathematics classes?**

12. Work as a total class

__ A. Daily
__ B. Two to three time a week
__ C. About once a week
__ D. About once a month
__ E. Less than once a month
__ F. Never

13. Work in a group

__ A. Daily
__ B. Two to three time a week
__ C. About once a week
__ D. About once a month
__ E. Less than once a month
__ F. Never

14. Work independently

__ A. Daily
__ B. Two to three time a week
__ C. About once a week
__ D. About once a month
__ E. Less than once a month
__ F. Never

15. Work with a teacher on a one-to-one basis

__ A. Daily
__ B. Two to three time a week
__ C. About once a week
__ D. About once a month
__ E. Less than once a month

16. Other (specify) _____

__ A. Daily
__ B. Two to three time a week
__ C. About once a week
__ D. About once a month
__ E. Less than once a month
__ F. Never

**ITEMS 17-32: How often do you do each of the following in your mathematics classes?**

17. Listen to a lecture or teacher's presentation

__ A. Daily
__ B. Two to three time a week
__ C. About once a week
__ D. About once a month
__ E. Less than once a month
__ F. Never

18. Participate in class discussions

__ A. Daily
__ B. Two to three time a week
__ C. About once a week
__ D. About once a month
__ E. Less than once a month
__ F. Never

19. Practice mathematics skills and facts--drill

__ A. Daily
__ B. Two to three time a week
__ C. About once a week
__ D. About once a month
__ E. Less than once a month
__ F. Never

20. Observe a teacher's demonstration

__ A. Daily
__ B. Two to three time a week
__ C. About once a week
__ D. About once a month
__ E. Less than once a month
__ F. Never

21. Complete written work (workbooks, worksheets, dittos, or other handouts)

__ A. Daily
__ B. Two to three time a week
__ C. About once a week
__ D. About once a month
__ E. Less than once a month
__ F. Never

22. Make a presentation to the class

__ A. Daily
__ B. Two to three time a week
__ C. About once a week
__ D. About once a month
__ E. Less than once a month
__ F. Never

23. Work at a learning station

__ A. Daily
__ B. Two to three time a week
__ C. About once a week
__ D. About once a month
__ E. Less than once a month
__ F. Never

24. Work math problems at the board

__ A. Daily
__ B. Two to three time a week
__ C. About once a week
__ D. About once a month
__ E. Less than once a month
__ F. Never

25. Study from math textbooks

__ A. Daily
__ B. Two to three time a week
__ C. About once a week
__ D. About once a month
__ E. Less than once a month
__ F. Never

26. Watch a filmstrip, film, slides, or television

__ A. Daily
__ B. Two to three time a week
__ C. About once a week
__ D. About once a month
__ E. Less than once a month
__ F. Never

27. Work on an individual or group project

__ A. Daily
__ B. Two to three time a week
__ C. About once a week
__ D. About once a month
__ E. Less than once a month
__ F. Never

28. Do homework in class

__ A. Daily
__ B. Two to three time a week
__ C. About once a week
__ D. About once a month
__ E. Less than once a month
__ F. Never

29. Do homework outside of class

__ A. Daily
__ B. Two to three time a week
__ C. About once a week
__ D. About once a month
__ E. Less than once a month
__ F. Never

30. Take a test or quiz

__ A. Daily
__ B. Two to three time a week
__ C. About once a week
__ D. About once a month
__ E. Less than once a month
__ F. Never

31. Use a computer

__ A. Daily
__ B. Two to three time a week
__ C. About once a week
__ D. About once a month
__ E. Less than once a month
__ F. Never

32. Be tutored individually

__ A. Daily
__ B. Two to three time a week
__ C. About once a week
__ D. About once a month
__ E. Less than once a month
__ F. Never

**ITEMS 33-35: Answer only if you are in a Vocational Trade or Industry Program.**

33. If you are in a Vocational Program, did you receive any of your mathematics credits as applied or related mathematics credits?

__ A. Yes
__ B. No
__ C. I don't know
__ D. I haven't completed two years of a program

34. Do you believe that this was the best way to earn your mathematics credits for graduation?

__ A. Yes
__ B. No (why?) _____
_____
__ C. I don't know

35. Are there any mathematics courses you would like to take that you do not have time to schedule into your program?

__ A. Yes (what are they?) _____
_____
__ B. No
__ C. I don't know

36. Have you ever failed a mathematics course?

__ A. Yes (answer question 37)
__ B. No (go to item 38)
__ C. I don't know (go to item 38)

37. Can you explain why?

_____
_____

**ITEMS 38-49: Please answer each of the following questions about your mathematics in the Anne Arundel County Public Schools.**

38. Do you like mathematics?

__ A. Yes
__ B. No
__ C. I don't know

39. Are you good at mathematics?

__ A. Yes
__ B. No
__ C. I don't know

40. Are you taking mathematics only because you have to?

__ A. Yes
__ B. No
__ C. I don't know

41. Would you like to take more mathematics?

__ A. Yes
__ B. No
__ C. I don't know

42. Do you usually understand what your teacher is talking about in mathematics?

__ A. Yes
__ B. No
__ C. I don't know

43. Would you like to work at a job that lets you use mathematics?

__ A. Yes
__ B. No
__ C. I don't know

44. Is mathematics more for boys than for girls?

__ A. Yes
__ B. No
__ C. I don't know

45. Is mathematics useful in solving everyday problems?

__ A. Yes
__ B. No
__ C. I don't know

46. Do you think that mathematics will be useful to you in the future?

__ A. Yes
__ B. No
__ C. I don't know

47. Do you think that you can get along well in everyday life without using mathematics?

__ A. Yes
__ B. No
__ C. I don't know

48. It is important to know arithmetic in order to get a good job?

__ A. Yes
__ B. No
__ C. I don't know

49. It is important to know mathematics such as algebra or geometry in order to get a good job?

__ A. Yes
__ B. No
__ C. I don't know

50. Do you think that your mathematics teachers this year knew what you had been taught in the math courses you took in previous years?

__ A. Yes
__ B. No
__ C. I don't know
__ D. I did not take any math courses this year

51. About how long did it take you to do the math homework your teacher assigned to be done outside of class? ____

_____

52. Is there anything else you would like to tell us about the Anne Arundel County Mathematics Program and your experiences in it? You may write your answer on the bottom of this page.

**ANNE ARUNDEL COUNTY PUBLIC SCHOOLS**

**OFFICE OF RESEARCH**

**MATHEMATICS PROGRAM EVALUATION**

**SURVEY OF STUDENTS WITH ALGEBRA I IN GRADE 7**

Dear Student:

The Anne Arundel County Public Schools System is evaluating its Mathematics Program. One part of this evaluation involves asking students who had Algebra I in seventh grade to answer a series of questions about their experiences with the Mathematics Program. All students who had Algebra I in grade seven during the 1980-81 and 1981-82 school years are being asked to complete this survey. Would you please take a little time to complete this survey. The answers you give to the survey questions will be used to help the Mathematics Program better meet the needs and interests of students like you. All the information which you give will be anonymous. Please return the completed survey within seven (7) days in the envelope which has been provided. Thank you.

**DIRECTIONS: Please answer the questions in this survey as they apply to your experiences in the Anne Arundel County Public Schools' Mathematics Program. Indicate your answers by marking an X in the space beside the most appropriate response to each question or by writing a comment when one is requested.**

Sex ___M ___F

What grade were you in during the past school year? _____

1. How well satisfied are you with the mathematics education you are receiving in the Anne Arundel County Public Schools?

   ___ A. Satisfied
   ___ B. Neither satisfied nor dissatisfied
   ___ C. Dissatisfied (why)? _____
   _____

2. How well satisfied are you with the number and variety of mathematics courses offered in high school?

   ___ A. Satisfied
   ___ B. Neither satisfied nor dissatisfied
   ___ C. Dissatisfied (why)? _____
   _____

3. Did you take Introduction to Algebra in grade 6?

   ___ A. Yes (answer items 4 and 5)
   ___ B. No (go to item 6)
   ___ C. I don't know (go to item 6)

4. Were you in an elementary or middle school in grade 6?

   ___ A. Elementary school
   ___ B. Middle school

5. Did Introduction to Algebra prepare you for Algebra I?

   ___ A. Yes
   ___ B. No (why not?) _____
   _____

6. What was your final grade in Algebra I?

   ___ A
   ___ B
   ___ C
   ___ D
   ___ E

7. Were you in a middle or junior high school in grade 7?

   ___ A. Middle school
   ___ B. Junior high school

**ITEMS 8-18: If you have taken any of the following courses since Algebra I, please indicate so by noting your final grade in the course.**

8. Algebra II

   ___ A
   ___ B
   ___ C
   ___ D
   ___ E

9. Algebra III

   ___ A
   ___ B
   ___ C
   ___ D
   ___ E

10. Fused Geometry

    ___ A
    ___ B
    ___ C
    ___ D
    ___ E

11. Trigonometry

    ___ A
    ___ B
    ___ C
    ___ D
    ___ E

12. Analytic Geometry

    ___ A
    ___ B
    ___ C
    ___ D
    ___ E

13. Applied Mathematics

    ___ A
    ___ B
    ___ C
    ___ D
    ___ E

14. Elementary Functions

___ A
___ B
___ C
___ D
___ E

15. Probability and Statistics

___ A
___ B
___ C
___ D
___ E

16. Computer Mathematics--Basic

___ A
___ B
___ C
___ D
___ E

17. Computer Mathematics--Fortran

___ A
___ B
___ C
___ D
___ E

18. Independent Study

___ A
___ B
___ C
___ D
___ E

19. Was the decision to take Algebra I in grade 7 a good one for you?

___ A. Yes
___ B. No (why not?) _____
_____
___ C. I don't know

20. Knowing what you know now, would you enroll in Algebra I in grade 7 again?

___ A. Yes
___ B. No (why not?) _____
_____
___ C. I don't know

21. How well prepared were you to take Algebra II?

___ A. I was well prepared.
___ B. I was prepared.
___ C. I was unprepared.
___ D. I have not taken Algebra II.

22. How well prepared were you to take Fused Geometry?

___ A. I was well prepared.
___ B. I was prepared.
___ C. I was unprepared.
___ D. I have not taken Fused Geometry.

23. Is there anything else you would like to tell us about the Anne Arundel County Mathematics Program and your experiences in it? You may write your answer on the bottom of this page.

ANNE ARUNDEL COUNTY PUBLIC SCHOOLS

MATHEMATICS PROGRAM EVALUATION

SURVEY OF FORMER STUDENTS

Dear Former Student:

The Anne Arundel County Public School System is evaluating its Mathematics Program. One part of this evaluation involves asking former students in Anne Arundel County Public Schools to answer a series of questions about their experiences with the mathematics courses they took in high school. Your name has been selected at random from students who were enrolled in one of the high schools in Anne Arundel County within the last six years. Would you please take a little time to answer the questions in this survey. The answers you give to the survey questions will be used to help the Mathematics Program better meet the needs and interests of students who are currently enrolled in the Anne Arundel County Public Schools. All the information which you give will be anonymous. Please return the completed survey within seven (7) days in the envelope which has been provided.

**Directions: Please answer the questions in this survey as they apply to your experiences in the Anne Arundel County Public Schools' Mathematics Program. Indicate your answers by marking an X in the space beside the most appropriate response to each question or by writing a comment when one is requested.**

Sex __M __F

1. What is your present employment status? (Choose one)
   - __ A. Working full-time
   - __ B. Working part-time
   - __ C. In the armed services
   - __ D. Unemployed
   - __ E. Other (specify) _____

2. In addition to your employment status do any of the following apply to you? (Choose one)
   - __ A. In school, full-time
   - __ B. In school, part-time
   - __ C. Homemaker, full-time
   - __ D. Other (specify) _____

3. If you are presently in school, what kind of school is it? (Choose one)
   - __ A. Trade, technical, or business school
   - __ B. Junior or community college
   - __ C. Four-year college or university
   - __ D. Graduate or professional school
   - __ E. Other (specify) _____

4. If you are not in school now but attended school after high school graduation, which of the following apply to you?
   - __ A. Graduated from a trade, technical, or business school
   - __ B. Graduated from a junior or community college
   - __ C. Graduated from a four-year college or university
   - __ D. Attended school after high school but did not graduate
   - __ E. Other (specify) _____

How many years were you enrolled in the Anne Arundel County Public Schools (excluding kindergarten)? _____

5. If you have attended school after graduating from high school, were you a mathematics major?
   - __ A. Yes
   - __ B. No

6. Did you graduate from high school?
   - __ A. Yes, from a public high school in Anne Arundel County
   - __ B. Yes, from a private high school in Anne Arundel County
   - __ C. Yes, from a high school ouside of Anne Arundel County
   - __ D. No

7. In which of the following programs were you enrolled in high school?
   - __ A. Academic
   - __ B. Business Education
   - __ C. Vocational Education
   - __ D. General
   - __ E. I don't know

8. How well satisfied are you with the mathematics education you received in the Anne Arundel County Public Schools?
   - __ A. Satisfied
   - __ B. Neither satisfied nor dissatisfied
   - __ C. Dissatisfied (why?) _____

9. How well satisfied are you with the number and variety of mathematics courses offered in high school?
   - __ A. Satisfied
   - __ B. Neither satisfied nor dissatisfied
   - __ C. Dissatisfied (why?) _____

10. If you could give a grade to the mathematics program, what grade would you give?

__ A __ D
__ B __ E
__ C

11. If you could give a grade to the mathematics teaching, what grade would you give?

__ A __ D
__ B __ E
__ C

12. Do you wish that you had taken additional mathematics courses in high school?

__ A. Yes (What subjects or courses would you like to have studied?) _____
_____
__ B. No
__ C. I don't know

13. Have you taken any mathematics courses since leaving high school?

__ A. Yes (answer item 14)
__ B. No (go to item 15)

14. How well did the mathematics courses you took in the Anne Arundel County Public Schools prepare you for these courses?

__ A. I was very well prepared.
__ B. I was prepared.
__ C. I was unprepared. (why?) _____
_____

15. How often does your job require a knowledge of math and using math skills?

__ A. Frequently
__ B. Occasionally
__ C. Rarely
__ D. Never

16. How well did the mathematics courses you took in the Anne Arundel County Public Schools prepare you for the math knowledge and skills required in your job?

__ A. I was very well prepared.
__ B. I was prepared.
__ C. I was unprepared. (why?) _____
_____
__ D. It is difficult to determine because this job required math knowledge and skills beyond those I took in high school.

Items 17-19: Tell whether you agree or disagree with each of the following statements about mathematics classes in general.

17. High school mathematics classes were useful

__ A. Agree
__ B. No opinion
__ C. Disagree

18. Much of what I learned in mathematics classes is useful to me in everyday life.

__ A. Agree
__ B. No opinion
__ C. Disagree

19. Much of what I learned in mathematics classes will be useful to me in the future.

__ A. Agree
__ B. No opinion
__ C. Disagree

20. If you were in a Vocational Trade Program, did you receive any of your mathematics credits as an applied mathematics credit?

__ A. Yes (answer item 21)
__ B. No (go to item 22)
__ C. I don't know (go to item 22)

21. Do you believe this was the best way to earn your mathematics credits for graduation?

__ A. Yes
__ B. No
__ C. I don't know

22. Did you ever fail a mathematics course in high school?

__ A. Yes (answer question 23)
__ B. No (go to item 24)
__ C. I don't know (go to item 24)

23. Can you explain why? _____
_____
_____

24. Is there anything else you would like to tell us about the Anne Arundel County Mathematics Program and your experiences in it? You may write you answer on the bottom of this page.

**ANNE ARUNDEL COUNTY PUBLIC SCHOOLS**

**OFFICE OF RESEARCH**

**MATHEMATICS PROGRAM EVALUATION**

SURVEY OF PRINCIPALS AND OTHER ADMINISTRATORS

Dear Principal, Assistant Principal or Adminstrative Intern:

At the direction of the Superintendent of Schools and the Board of Education, the Office of Research is coordinating and conducting an evaluation of the kindergarten through grade twelve Mathematics Program. The purpose of the evaluation is to answer a series of questions which have been raised about the mathematics curriculum, mathematics instruction, and students' performance in, attitudes about, and later success in mathematics. The questions have been raised by mathematics teachers, mathematics department chairpersons, the School Directors, the Coordinator of Mathematics, and the School and Program Evaluation Committee. Some of the questions raised are best answered by school administrators, so your response to the survey is very important. Please take time to complete the survey so that the responses of administrators are represented in the evaluation final report.

Thank you for the time you give to complete the survey. Please return the survey and General Purpose Answer Sheet within seven (7) days by basket mail to the Office of Research.

**DIRECTIONS: Please respond to the items on this survey by marking your answers on a General Purpose Answer Sheet. Code each answer by darkening the bubble on the answer sheet that corresponds to the number of the survey item and letter of your response to that item. For example, if your response to item 1 (What is your current position?) is principal (choice A), you will darken bubble 1A on the answer sheet.**

**Please respond to the survey items with reference to the total mathematics program in the school.**

**When comments are asked for, they may be written directly on the survey and returned with your answer sheet. All survey responses are to be anonymous. Do not complete any of the sections of the answer sheet which request personal information (e.g., name, sex, birth date).**

Note: Principals, assistant principals, adminstrative interns, mathematics department chairpersons, mathematics teachers, and guidance counselors in elementary, middle, junior high, and senior high schools are being surveyed to gather information for the Mathematics Program Evaluation. Each survey asks some questions specific to the staff member and/or school level. Therefore, it is necessary to ask questions 1 and 2 to determine what staff member and what level of school each answer sheet represents.

**Professional Information**

1. What is your current position?
   A. Principal
   B. Assistant principal or adminstrative intern
   C. Mathematics department chairperson
   D. Mathematics teacher
   E. Guidance counselor
   F. Other (specify) _____
   _____

2. At what level are you currently employed?
   A. Elementary school
   B. Middle school
   C. Junior high school
   D. Senior high school

**Questions about the Mathematics Curriculum***

3. To what degree has the Anne Arundel County mathematics curriculum been implemented in this school?
   A. To a great degree
   B. To an adequate degree
   C. To a little degree
   D. Not at all

4. Is there any unnecessary duplication in the mathematics content from grade to grade or course to course?
   A. Yes (where?) _____
   _____
   B. No
   C. I don't know

5. Which of the following do teachers use in planning mathematics instruction? (Check all that apply)
   A. Mathematics Goals and Objectives
   B. Mathematics Scope and Sequence Chart
   C. Unified Mathematics Booklets A, B, C and D
   D. Elective Mathematics Course Guides
   E. Mathematics textbooks
   F. Teacher's/students' backgrounds and interests
   G. Other (what?) _____
   _____

6. Are teachers comfortable teaching the Anne Arundel County Mathematics Curriculum?
   A. Yes
   B. No (why not?) _____
   _____
   C. I don't know

**Questions about the Mathematics Gifted/Talented Program**

7. Does the mathematics program for gifted/talented students differ substantially from the regular mathematics program in this school?
   A. Yes
   B. No (why not?) _____
   _____
   C. I don't know

* The Mathematics Curriculum is defined as the Goals and Objectives for Mathematics; the Mathematics Scope and Sequence Chart; Unified Mathematics Booklets A,B,C and D; and all elective course guides.

8. Which of the following most accurately describes how students are selected for gifted/talented program offerings in this school?
   A. Students are identified and selected separately in each subject area
   B. Students are identified and selected globally (i.e., for participation in all gifted/talented programs offered at this school)
   C. Other (specify) _____

9. What kinds of courses do you counsel highly able mathematics students to schedule? (check all that apply)
   A. Advanced Placement Calculus
   B. Elective Mathematics Courses other than AP Calculus (what are they?) _____

**Questions about Student Assessment**

**ITEMS 10-17: Which of the following are used to assign students to instructional groups or courses?**

10. California Achievement Test scores
    A. Yes
    B. No
    C. I don't know

11. Teacher made test scores
    A. Yes
    B. No
    C. I don't know

12. Math basic textbooks completed
    A. Yes
    B. No
    C. I don't know

13. Scores from end of unit tests in basic textbooks
    A. Yes
    B. No
    C. I don't know

14. Informal assessments
    A. Yes
    B. No
    C. I don't know

15. Maryland Functional Mathematics Test scores
    A. Yes
    B. No
    C. I don't know

16. Information on the Individual Mathematics Record
    A. Yes
    B. No
    C. I don't know

17. Other (specify) _____
    A. Yes
    B. No

**Questions about Other Topics**

18. Are there enough inservice opportunities available to teachers to ensure that the mathematics curriculum is taught effectively?
    A. Yes
    B. No (what kinds are needed?) _____
    C. I don't know

19. What is your opinion about increasing the number of required mathematics credits for graduation to three?
    A. Three credits are too low. (How many should be required?) _____
    B. Three credits are about right.
    C. Three credits are too high. (How many should be required?) _____

**ITEMS 20-22: To be answered only by elementary administrators**

20. How is mathematics instruction organized in this school?
    A. It is departmentalized
    B. It is self-contained (each teacher is responsible)
    C. Other (specify) _____

21. Who is responsible for choosing the mathematics textbooks teachers use?
    A. Principal
    B. Teachers
    C. Principal and teachers jointly
    D. Other (specify) _____

22. Do teachers teach mathematics to any combination classes? (e.g., grades 2-3 together)
    A. Yes (please comment on the effect on mathematics instruction, if any) _____
    B. No

**ITEMS 23 and 24: To be answered only by elementary and middle school adminstrators**

23. Is Unified Math 6 offered to sixth grade students in elementary and middle schools comparable?
    A. Yes
    B. No (how are they different?) _____
    C. I don't know

24. Is Introduction to Algebra offered to sixth grade students in elementary and middle schools comparable?
    A. Yes
    B. No (how are they different?) _____
    C. I don't know

**ITEMS 25-27: To be answered only by secondary administrators**

25. Can adjustments be made in a student's placement other than at the end of a semester?
    A. Yes
    B. No

26. Should Algebra I be offered in grade 7?
    A. Yes
    B. No (why not?) _____
    C. I don't know

27. Has your school been part of the Instructional Leadership Project?
    A. Yes, and this is the first year
    B. Yes, and this is the second year
    C. Yes, and this is the third year
    D. Yes, and this is the fourth year
    E. No
    F. I don't know

**ITEMS 28-31: To be answered only by senior high school administrators**

28. Is the number of courses adequate to meet the diverse educational needs of students in grades 9 through 12?
    A. Yes
    B. No (why not?) _____
    _____
    C. I don't know

29. Are there any differences between Unified Math in grades 9 through 12 as the courses are implemented?
    A. Yes
    B. No
    C. I don't know

30. How are students assigned to Unified Math in grades 9 through 12?
    A. By grade level
    B. By ability level
    C. By grade and ability level
    D. Other (specify) _____
    _____

31. Do you believe that students enrolled in trade programs at the Vo-Tech Centers should receive an applied mathematics credit toward graduation upon satisfactorily completing two years of a trade program?
    A. Yes
    B. No

**DIRECTIONS: THE FINAL QUESTIONS ARE OPEN-ENDED. PLEASE ANSWER EACH QUESTION AS BRIEFLY AS POSSIBLE. IF YOU NEED MORE ROOM TO ANSWER A QUESTION THAN IS PROVIDED ON THESE PAGES, PLEASE FEEL FREE TO CONTINUE ON AN ADDITIONAL SHEET OF PAPER.**

32. Are microprocessors available for mathematics instruction in this school? If so, how are teachers using microprocessors in mathematics instruction?

33. What types of assistance are needed in this school to help increase the effectiveness of mathematics instruction?

34. How are students selected for gifted/talented mathematics programs?

**ITEMS 35 and 36: To be answered only by elementary adminstrators**

35. How much time do teachers spend weekly in mathematics instruction? How is the instruction scheduled over five days?

36. What is the effect of mathematics instruction in kindergarten on the elementary school mathematics curriculum?

**ITEMS 37-39: To be answered only by elementary and middle school adminstrators**

37. What information do you use to select students for Introduction to Algebra in grade 6?

38. What are the characteristics of students who are successful in Introduction to Algebra in grade 6?

39. When students are unsuccessful in Introduction to Algebra in grade 6, what are the major reasons?

ITEMS 40-44: **To be answered only by middle and junior high school administrators**

40. What information do you use to select students for Algebra I in grade 7?

41. What are the characteristics of students who succeed in Algebra I in grade 7?

42. When students are unsuccessful in Algebra I in grade 7, what are the major reasons?

43. What should the instrucional sequence be for students who are unsuccessful in Introduction to Algebra in grade 6?

44. What should the instructional sequence be for students who are unsuccessful in Algebra I in grade 7?

**ITEMS 45-47: To be answered only be senior high school administrators**

45. What are the characteristics of students who are successful in high school academic mathematics courses?

46. What are the major reasons students experience failure in high school academic mathematics courses?

47. How are students selected for AP Calculus?

**ITEM 48: To be answered only by secondary administrators**

48. If this school is part of the Instructional Leadership Project, what has its impact been on mathematics instruction?

49. Is there anything else that you haven't previously written that you would like us to know about the Mathematics Program?

**ANNE ARUNDEL COUNTY PUBLIC SCHOOLS**

**OFFICE OF RESEARCH**

**MATHEMATICS PROGRAM EVALUATION**

SURVEY OF GUIDANCE COUNSELORS

Dear Guidance Counselor:

At the direction of the Superintendent of Schools and the Board of Education, the Office of Research is coordinating and conducting an evaluation of the kindergarten through grade twelve Mathematics Program. The purpose of the evaluation is to answer a series of questions which have been raised about the mathematics curriculum, mathematics instruction, and students' performance in, attitudes about, and later success in mathematics. The questions have been raised by mathematics teachers, mathematics department chairpersons, the School Directors, the Coordinator of Mathematics, and the School and Program Evaluation Committee. Some of the questions raised are best answered by guidance counselors, so your response to the survey is very important. Please take time to complete the survey so that the responses of guidance counselors are represented in the evaluation final report.

Thank you for the time you give to complete the survey. Please return the survey and General Purpose Answer Sheet within seven (7) days by basket mail to the Office of Research.

**DIRECTIONS: Please respond to the items on this survey by marking your answers on a General Purpose Answer Sheet. Code each answer by darkening the bubble on the answer sheet that corresponds to the number of the survey item and letter of your response to that item. For example, if your response to item 1 (What is your current position?) is guidance counselor (choice E), you will darken bubble 1E on the answer sheet.**

**Please respond to the survey items with reference to the total mathematics program in the school.**

**When comments are asked for, they may be written directly on the survey and returned with your answer sheet. All survey responses are to be anonymous. Do not complete any of the sections of the answer sheet which request personal information (e.g., name, sex, birth date).**

Note: Principals, mathematics department chairpersons, mathematics teachers, and guidance counselors in elementary, middle, junior high, and senior high schools are being surveyed to gather information for the Mathematics Program Evaluation. Each survey asks some questions specific to the staff member and/or school level. Therefore, it is necessary to ask questions 1 and 2 to determine what staff member and what level of school each answer sheet represents.

**Professional Information**

1. What is your current position?
   A. Principal
   B. Assistant principal
   C. Mathematics department chairperson
   D. Mathematics teacher
   E. Guidance counselor
   F. Other (specify) _____
   _____

2. At what level are you currently employed?
   A. Elementary school
   B. Middle school
   C. Junior high school
   D. Senior high school

**Questions about the Mathematics Curriculum ***

3. Does the mathematics curriculum match students' cognitive development at each grade level?
   A. Yes
   B. No (why not?) _____
   _____
   C. I don't know

4. Do the skills and content in the mathematics curriculum meet the diverse educational needs of students at each grade level?
   A. Yes
   B. No (why not?) _____
   _____
   C. I don't know

5. Is the number of courses adequate to meet the diverse educational needs of students in grades 9 through 12?
   A. Yes
   B. No (why not?) _____
   _____
   C. I don't know

6. Is there any unnecessary duplication in the mathematics content from grade to grade or course to course?
   A. Yes (where?) _____
   _____
   B. No
   C. I don't know

**Questions about Career Education in Mathematics**

7. Are students made aware of the mathematics requirements for the career opportunities in which they are interested?
   A. Yes (answer item 8)
   B. No (go to item 9)

8. At what grade level do students know the mathematics requirements for the career opportunities in which they are interested?
   A. Prior to grade 6
   B. Grade 6
   C. Grade 7
   D. Grade 8
   E. Grade 9
   F. Grade 10
   G. Grade 11
   H. Grade 12
   I. Other (when?) _____
   J. I don't know

*The Mathematics Curriculum is defined as the Goals and Objectives for Mathematics; the Mathematics Scope and Sequence Chart; Unified Mathematics Booklets A, B, C, and D; and all elective course guides.

**Questions about the Mathematics Gifted/Talented Program**

9. Which of the following most accurately describes how students are selected for gifted/talented program offerings in this school?
   A. Students are identified and selected separately in each subject area
   B. Students are identified and selected globally (i.e., for participation in all gifted/talented programs offered at this school)
   C. Other (specify) _____
   _____

10. Does the mathematics program for gifted/talented students differ substantially from the regular mathematics program in this school?
   A. Yes
   B. No (why not?) _____
   _____
   C. I don't know

11. What kinds of courses do you counsel highly able mathematics students to schedule? (check all that apply)
   A. Advanced Placement Calculus
   B. Elective Mathematics Courses other than AP Calculus (What are they?) _____
   _____

**Questions about Student Assessment**

**ITEMS 12-19: Which of the following are used to assign students to instructional groups or courses?**

12. California Achievement Test scores
   A. Yes
   B. No
   C. I don't know

13. Teacher made test scores
   A. Yes
   B. No
   C. I don't know

14. Math basic textbooks completed
   A. Yes
   B. No
   C. I don't know

15. Scores from end of unit tests in basic textbooks
   A. Yes
   B. No
   C. I don't know

16. Informal assessments
   A. Yes
   B. No
   C. I don't know

17. Maryland Functional Mathematics Test scores
   A. Yes
   B. No
   C. I don't know

18. Information on the Individual Mathematics Record
   A. Yes
   B. No
   C. I don't know

19. Other (specify) _____
   A. Yes
   B. No

**ITEMS 20-23: To be answered only by counselors of ninth grade students**

20. Do you know which students assigned to you have failed the Maryland Functional Mathematics Test?
   A. Yes
   B. No

21. Do you know what skills students who fail the Maryland Functional Mathematics Test will need to learn?
   A. Yes
   B. No

22. Do you know the seven unified mathematics strands?
   A. Yes (answer item 23)
   B. No (go to item 24)

23. Do you know on which strands ninth graders performed poorly this year?
   A. Yes
   B. No

**Questions about Other Topics**

**ITEM 24: To be answered only by counselors of students in grades 9 through 12**

24. How are students assigned to Unified Math in grades 9 through 12?
   A. By grade level
   B. By ability level
   C. By grade and ability level
   D. Other (specify) _____
   _____
   E. I don't know

**ITEMS 25-27: To be answered only by secondary counselors**

25. What is your opinion about increasing the number of required mathematics credits for graduation to three?
   A. Three credits are too low. (How many credits should be required?) _____
   B. Three credits are about right.
   C. Three credits are too high. (How many credits should be required?) _____

26. Can adjustments be made in a student's placement other than at the end of a semester?
   A. Yes
   B. No

27. Has your school been part of the Instructional Leadership Project?
   A. Yes, and this is the first year
   B. Yes, and this is the second year
   C. Yes, and this is the third year
   D. Yes, and this is the fourth year
   E. No
   F. I don't know

**DIRECTIONS: THE FINAL QUESTIONS ARE OPEN-ENDED. PLEASE ANSWER EACH QUESTION AS BRIEFLY AS POSSIBLE. IF YOU NEED MORE ROOM TO ANSWER A QUESTION THAN IS PROVIDED ON THESE PAGES, PLEASE FEEL FREE TO CONTINUE ON AN ADDITIONAL SHEET OF PAPER.**

28. How are students selected for gifted/talented mathematics programs in this school?

29. How are students assigned to sections/courses for math instruction?

30. What procedures do you follow to ensure that students are correctly placed in mathematics classes/courses?

31. What are students' attitudes and comments about mathematics courses compared to other courses?

**ITEMS 32-34: To be answered only by counselors in elementary and middle schools**

32. What information do you use to select students for Introduction to Algebra in grade 6?

33. What are the characteristics of students who are successful in Introduction to Algebra in grade 6?

34. When students are unsuccessful in Introduction to Algebra in grade 6, what are the major reasons?

**ITEMS 35-37: To be answered only by counselors in middle and junior high schools**

35. What information do you use to select students for Algebra I in grade 7?

36. What are the characteristics of students who succeed in Algebra I in grade 7?

37. When students are unsuccessful in Algebra I in grade 7, what are the major reasons?

**ITEMS 38-40: To be answered only by counselors of students in grades 9 through 12**

38. What are the characteristics of students who are successful in high school academic mathematics courses?

39. What are the reasons students experience failure in high school academic mathematics courses?

40. What are students' reasons for taking or not taking additional mathematics courses beyond those required?

**ITEM 41: To be answered only by secondary counselors**

41. If this school is part of the Instructional Leadership Project, what has its impact been on mathematics instruction?

42. Is there anything else that you haven't previously written that you would like us to know about the Mathematics Program?

**ANNE ARUNDEL COUNTY PUBLIC SCHOOLS**

**OFFICE OF RESEARCH**

**MATHEMATICS PROGRAM EVALUATION**

SURVEY OF ELEMENTARY TEACHERS

Dear Elementary Mathematics Teacher:

At the direction of the Superintendent of Schools and the Board of Education, the Office of Research is coordinating and conducting an evaluation of the kindergarten through grade twelve Mathematics Program this school year. The purpose of the evaluation is to answer a series of questions about the mathematics curriculum, mathematics instruction, and students' performance in, attitudes about, and later success in mathematics. Some of the questions have been raised by mathematics teachers, as well as by the School Directors, the Coordinator of Mathematics, School and Program Evaluation Committee, and mathematics department chairpersons. Your response to the survey is very important. Please take time to complete the survey so that the responses of elementary mathematics teachers to the survey questions are represented in the evaluation final report.

Thank you for the time you give to complete this survey. Please return the survey and General Purpose Answer Sheet within seven (7) days by basket mail to the Office of Research.

**DIRECTIONS: Please respond to the items on this survey by marking your answers on a General Purpose Answer Sheet. Code each answer by darkening the bubble on the answer sheet that corresponds to the number of the survey item and letter of your response to that item. For example, if your response to item 1 (What is your current position?) is mathematics teacher (choice D), you will darken bubble 1D on the answer sheet.**

**When comments are asked for, they may be written directly on the survey and returned with your answer sheet. All survey responses are to be anonymous. Do not complete any of the section of the answer sheet which requests personal information (e.g., name, sex, birth date).**

**Please respond to the survey items with reference to the mathematics classes you teach this year.**

**Code the grade or grades you teach mathematics by darkening the appropriate bubble(s) under GRADE or EDUC.**

Note: Principals, mathematics department chairpersons, mathematics teachers, and guidance counselors in elementary, middle, junior high, and senior high schools are being surveyed to gather information for the Mathematics Program Evaluation. Each survey asks some questions specific to the staff member and/or school level. Therefore, it is necessary to ask questions 1 and 2 to determine what staff member and what level of school each answer sheet represents.

1. What is your current position?
   A. Principal
   B. Assistant principal
   C. Mathematics department chairperson
   D. Mathematics teacher
   E. Guidance counselor
   F. Other (specify) _____
   _____

2. At what level are you currently employed?
   A. Elementary school
   B. Middle school
   C. Junior high school
   D. Senior high school

3. What teaching certificate(s) do you currently hold? (Code all that apply)
   A. Mathematics (grades 5-12)
   B. Elementary (grades 1-6 plus middle school)
   C. Elementary (grades 1-6) mathematics (7-9)
   D. Early Childhood
   E. Other (what area?) _____
   F. None

4. How long have you been teaching mathematics?
   A. 1 year or less
   B. 2 years
   C. 3 to 5 years
   D. 6 to 10 years
   E. More than 10 years

**Questions about the Mathematics Curriculum***

5. To what degree has the Anne Arundel County mathematics curriculum been implemented in the grades you teach?
   A. To a great degree
   B. To an adequate degree
   C. To a little degree
   D. Not at all

6. Does the mathematics curriculum match students' cognitive development in the grades you teach?
   A. Yes
   B. No (why not?) _____
   _____
   C. I don't know

7. Do the skills and content in the mathematics curriculum meet the diverse educational needs of students in the grades you teach?
   A. Yes
   B. No (why not?) _____
   _____
   C. I don't know

*The Mathematics Curriculum is defined as the Mathematics Goals and Objectives, Mathematics Scope and Sequence Chart, and Unified Math Booklets ABC.

8. Which of the following do you use in planning mathematics instruction? (Code all that you use.)
   A. Mathematics Goals and Objectives
   B. Mathematics Scope and Sequence Chart
   C. Unified Mathematics Booklets ABC
   D. Mathematics textbooks
   E. Teacher's/students' backgrounds and interests
   F. Other (what?) _____
   _____

9. Is there any unnecessary duplication in the mathematics content from grade to grade?
   A. Yes (where?) _____
   _____
   B. No
   C. I don't know

10. Are the mathematics content and skills which you introduce reinforced in subsequent grades?
   A. Yes
   B. No
   C. I don't know

11. Are there topics/skills omitted from earlier grades which students need to know in the grades that you teach?
   A. Yes (what are they?) _____
   _____
   B. No
   C. I don't know

12. Do you believe you are well prepared to teach the mathematics grades you are now teaching?
   A. Yes
   B. No (why not?) _____
   _____
   C. I don't know

13. Are you comfortable teaching the Anne Arundel County Mathematics Curriculum?
   A. Yes
   B. No (why not?) _____
   _____
   C. I don't know

Items 14-20: Listed below are the seven Unified Mathematics strands. Please indicate for each strand if the emphasis in the Scope and Sequence Chart and ABC Booklets is appropriate at the grade(s) you teach.

14. Analysis of number and numeration systems
   A. There is too much emphasis of this strand.
   B. The emphasis of this strand is about right.
   C. There is too little emphasis of this strand.

15. Numeric and algebraic operations
   A. There is too much emphasis of this strand.
   B. The emphasis of this strand is about right.
   C. There is too little emphasis of this strand.

16. Graphic Operations
   A. There is too much emphasis of this strand.
   B. The emphasis of this strand is about right.
   C. There is too little emphasis of this strand.

17. Geometry
   A. There is too much emphasis of this strand.
   B. The emphasis of this strand is about right.
   C. There is too little emphasis of this strand.

18. Measurement and probability
   A. There is too much emphasis of this strand.
   B. The emphasis of this strand is about right.
   C. There is too little emphasis of this strand.

19. Sets and Logic
   A. There is too much emphasis of this strand.
   B. The emphasis of this strand is about right.
   C. There is too little emphasis of this strand.

20. Problem Solving
   A. There is too much emphasis of this strand.
   B. The emphasis of this strand is about right.
   C. There is too little emphasis of this strand.

**Questions about the Unified Mathematics Booklets ABC**

21. Are the Unified Math Booklets ABC that you use complete?
   A. Yes
   B. No (why not?) _____
   _____
   C. I don't know

22. Are the Unified Math Booklets ABC that you use clear?
   A. Yes
   B. No (why not?) _____
   _____
   C. I don't know

23. How easy or difficult is it for you to teach mathematics using the Anne Arundel County Unified Math Booklets ABC?
   A. Easy
   B. Neither easy nor difficult
   C. Difficult (why?) _____

24. Are the basic materials of instruction listed in the Unified Math Booklets ABC that you use appropriate for the instructional activities you teach?
   A. Yes
   B. No (why not?) _____
   _____
   C. I don't know

25. Should the Unified Mathematics Booklets ABC be changed in any way to make them easier to use?
   A. Yes (how?) _____
   _____
   B. No
   C. I don't know

26. Would you like to have a curriculum guide for each grade level you teach?
   A. Yes
   B. No
   C. I don't know.

27. Are Anne Arundel County developed Unified Mathematics Booklets ABC available to you in sufficient supply?
   A. Yes
   B. No

**Questions about Materials of Instruction**

28. Do you have a basic textbook for each grade you teach?
   A. Yes
   B. No

29. Do you have enough supplementary textbooks for regrouping students?
    A. Yes
    B. No

30. Do you have enough equipment to teach the mathematics curriculum?
    A. Yes
    B. No

31. Are the Anne Arundel County Scope and Sequence Chart and ABC Booklets useful when selecting basic textbooks used in your school?
    A. Yes
    B. No (why not?) _____
    _____

32. Do the basic textbooks used in your school reflect the County curriculum?
    A. Yes
    B. No (why not?) _____
    _____

33. Are the manipulatives you have adequate to teach at your grade level?
    A. Yes
    B. No (why not?) _____
    _____

34. Who is responsible for choosing the mathematics textbook you use in your classes?
    A. Principal
    B. Teachers
    C. Principal and teachers jointly
    D. Other (specify) _____
    _____

**Questions about Mathematics Instruction**

35. How is mathematics instruction organized at the grade level you teach?
    A. It is departmentalized
    B. It is self-contained (each teacher is responsible)
    C. Other (specify) _____
    _____

36. Do you teach mathematics to any combination classes? (e.g., grades 2-3 together)
    A. Yes (Please comment on the effect on mathematics instruction, if any) _____
    _____
    B. No

37. Do you know what mathematics skills/content are taught in the grade which immediately precedes the one you teach?
    A. Yes
    B. No
    C. I don't know

38. Do you know what mathematics skills/content are taught in the grade which immediately follows the one you teach?
    A. Yes
    B. No
    C. I don't know

ITEMS 39-42: How often do you use each of the following grouping strategies when teaching mathematics?

39. Total class presentations or discussions
    A. Daily
    B. Two to three times a week
    C. About once a week
    D. Once or twice a month
    E. Less than once a month
    F. Never

40. Discussions, group work, or projects in two or more groups
    A. Daily
    B. Two to three times a week
    C. About once a week
    D. Once or twice a month
    E. Less than once a month
    F. Never

41. Independent work
    A. Daily
    B. Two to three times a week
    C. About once a week
    D. Once or twice a month
    E. Less than once a month
    F. Never

42. Teacher-student work on a one-to-one basis
    A. Daily
    B. Two to three times a week
    C. About once a week
    D. Once or twice a month
    E. Less than once a month
    F. Never

43. Other (specify) _____
    _____
    A. Daily
    B. Two to three times a week
    C. About once a week
    D. Once or twice a month
    E. Less than once a month
    F. Never

44. Discounting seatwork, on the average how many minutes of direct instruction does each student receive daily?

| | |
|---|---|
| A. Five minutes or less | F. 26-30 minutes |
| B. 6-10 minutes | G. 31-35 minutes |
| C. 11-15 minutes | H. 36-40 minutes |
| D. 16-20 minutes | I. 41-45 minutes |
| E. 21-25 minutes | J. More than 45 minutes |

ITEMS 45-61: How often do you use each of the following when teaching mathematics?

45. Drill
    A. Daily
    B. Two to three times a week
    C. About once a week
    D. Once or twice a month
    E. Less than once a month
    F. Never

46. Lectures
    A. Daily
    B. Two to three times a week
    C. About once a week
    D. Once or twice a month
    E. Less than once a month
    F. Never

47. Discussion
A. Daily
B. Two to three times a week
C. About once a week
D. Once or twice a month
E. Less than once a month
F. Never

48. Teacher demonstrations
A. Daily
B. Two to three times a week
C. About once a week
D. Once or twice a month
E. Less than once a month
F. Never

49. Written work (dittos, work sheets)
A. Daily
B. Two to three times a week
C. About once a week
D. Once or twice a month
E. Less than once a month
F. Never

50. Board work
A. Daily
B. Two to three times a week
C. About once a week
D. Once or twice a month
E. Less than once a month
F. Never

51. Student presentations
A. Daily
B. Two to three times a week
C. About once a week
D. Once or twice a month
E. Less than once a month
F. Never

52. Learning stations
A. Daily
B. Two to three times a week
C. About once a week
D. Once or twice a month
E. Less than once a month
F. Never

53. Simulations and games
A. Daily
B. Two to three times a week
C. About once a week
D. Once or twice a month
E. Less than once a month
F. Never

54. Discovery learning
A. Daily
B. Two to three times a week
C. About once a week
D. Once or twice a month
E. Less than once a month
F. Never

55. Inquiry or problem solving
A. Daily
B. Two to three times a week
C. About once a week
D. Once or twice a month
E. Less than once a month
F. Never

56. Television, film, or other media presentation
A. Daily
B. Two to three times a week
C. About once a week
D. Once or twice a month
E. Less than once a month
F. Never

57. Administering tests and quizzes
A. Daily
B. Two to three times a week
C. About once a week
D. Once or twice a month
E. Less than once a month
F. Never

58. Tutoring students outside of class
A. Daily
B. Two to three times a week
C. About once a week
D. Once or twice a month
E. Less than once a month
F. Never

59. Assigning homework to be done in class
A. Daily
B. Two to three times a week
C. About once a week
D. Once or twice a month
E. Less than once a month
F. Never

60. Assigning homework to be done outside of class
A. Daily
B. Two to three times a week
C. About once a week
D. Once or twice a month
E. Less than once a month
F. Never

61. Other (specify)_____
_____
A. Daily
B. Two to three times a week
C. About once a week
D. Once or twice a month
E. Less than once a month
F. Never

62. About how long do you estimate it requires students to complete homework assigned to be done outside of class?
A. One to 15 minutes
B. 16 to 30 minutes
C. 31 to 45 minutes
D. 46 to 60 minutes
E. More than 60 minutes.

**Questions about Mathematics for Gifted/Talented Students**

63. Which of the following most accurately describes how students are selected for gifted/talented program offerings in this school?
    A. Students are identified and selected separately in each subject area
    B. Students are identified and selected globally (i.e., for participation in all gifted/talented programs offered at this school)
    C. Other (specify) _____
    _____
    D. I don't know

**ITEM 64 and 65 ARE TO BE ANSWERED BY TEACHERS OF THE GIFTED/TALENTED PROGRAM ONLY**

64. Does the mathematics program for gifted/talented students differ substantially from the regular mathematics program in this school?
    A. Yes (how?) _____
    _____
    B. No
    C. I don't know

65. Do the selection criteria for the gifted/talented mathematics program seem to correlate with high mathematics aptitudes?
    A. Yes
    B. No (why not?) _____
    _____
    C. I don't know

**Questions about Inservice Opportunities**

ITEMS 66-76: Listed below are the various ways in which instructional assistance can be provided to help teachers implement and/or teach the mathematics program. Please indicate whether or not you have received each of the following types of assistance and how helpful this assistance has been.

66. Working with the team leader in mathematics
    A. I have not received this type of assistance.
    B. I have received this type of assistance; it has been helpful.
    C. I have received this type of assistance; it has not been helpful.
    D. This school does not have a team leader in mathematics.

67. Working with the principal
    A. I have not received this type of assistance.
    B. I have received this type of assistance; it has been helpful.
    C. I have received this type of assistance; it has not been helpful.

68. Working with the assistant principal or administrative intern
    A. I have not received this type of assistance.
    B. I have received this type of assistance; it has been helpful.
    C. I have received this type of assistance; it has not been helpful.
    D. This school does not have an assistant principal or intern.

69. Working with another mathematics teachers
    A. I have not received this type of assistance.
    B. I have received this type of assistance; it has been helpful.
    C. I have received this type of assistance; it has not been helpful.

70. Enrolling in graduate courses related to teaching mathematics
    A. I have not received this type of assistance.
    B. I have received this type of assistance; it has been helpful.
    C. I have received this type of assistance; it has not been helpful.

71. Enrolling in county workshops related to teaching mathematics
    A. I have not received this type of assistance.
    B. I have received this type of assistance; it has been helpful.
    C. I have received this type of assistance; it has not been helpful.

72. Working with the Coordinator of Mathematics
    A. I have not received this type of assistance.
    B. I have received this type of assistance; it has been helpful.
    C. I have received this type of assistance; it has not been helpful.

73. Working with resource teachers
    A. I have not received this type of assistance.
    B. I have received this type of assistance; it has been helpful.
    C. I have received this type of assistance; it has not been helpful.

74. Using County developed curriculum materials
    A. I have not used this type of material.
    B. I have used this type of material; it has been helpful.
    C. I have used this type of material; it has not been helpful.

75. Using professional journals
    A. I have not used this type of material.
    B. I have used this type of material; it has been helpful.
    C. I have used this type of material; it has not been helpful.

76. Other (specify) _____
    A. I have not received this type of assistance.
    B. I have received this type of assistance; it has been helpful.
    C. I have received this type of assistance; it has not been helpful.

77. Are there enough inservice opportunities available to you to ensure that you can teach the mathematics curriculum effectively?
    A. Yes
    B. No (What kinds are needed?) _____
    C. I don't know

ITEMS 78-87: Which of the following do you use at the beginning of a unit to diagnose students' instructional needs in mathematics and to group students for mathematics instruction?

78. Norm referenced standardized tests
    A. Yes
    B. No

79. Published criterion referenced tests
    A. Yes
    B. No

80. Teacher made tests
    A. Yes
    B. No

81. Tests in textbooks or teacher's guides
    A. Yes
    B. No

82. Informal assessments or inventories
    A. Yes
    B. No

83. Information in cumulative records
    A. Yes
    B. No

84. Anecdotal records
    A. Yes
    B. No

85. Individual Mathematics Records
    A. Yes
    B. No

86. Class records
    A. yes
    B. No

87. Other (specify) _____
    A. Yes
    B. No

ITEMS 88-95: Which of the following do you use at the end of a course or year to determine a student's mastery?

88. Norm referenced standardized tests
    A. Yes
    B. No

89. Published criterion referenced tests
    A. Yes
    B. No

90. Teacher made tests
    A. Yes
    B. No

91. Tests in textbooks or teacher's guides
    A. Yes
    B. No

92. Informal assessments or inventories
    A. Yes
    B. No

93. Individual Mathematics Records
    A. Yes
    B. No

94. Class records
    A. Yes
    B. No

95. Other (specify) _____
    A. Yes
    B. No

**Questions about Introduction to Algebra**

**ITEM 96 IS TO BE ANSWERED ONLY BY TEACHERS OF INTRODUCTION TO ALGEBRA**

96. Do you have enough time to complete the outline for Introduction to Algebra?
    A. Yes
    B. No

**Questions about Professional Organizations**

To what professional organizations of mathematics educators do you belong?

97. National Council for Teachers of Mathematics
    A. Yes
    B. No

98. Maryland Council for Teachers of Mathematics
    A. Yes
    B. No

99. Other (specify) _____
    A. Yes
    B. No

**DIRECTIONS: The final questions are open-ended. Please answer each question as briefly as possible. If you need more room to answer a question than is provided on these pages, please feel free to continue on an additional sheet of paper.**

101. Are microprocessors available for mathematics instruction in this school? If so, how are you using microprocessors in mathematics instruction?

101. What types of assistance do you need to help increase the effectiveness of mathematics instruction?

102. Do you maintain the Individual Mathematics Record? How do you use the information in it? How can the Individual Mathematics Record best be used?

103. Do you have any feelings or comments about how mathematics instruction is organized at the grade levels you teach (e.g., self-contained versus departmentalized)?

104. How much time do you spend weekly in mathematics instruction? How is the instruction scheduled over five days?

**ITEM 105 IS TO BE ANSWERED BY KINDERGARTEN AND PRIMARY TEACHERS ONLY**

105. What is the effect of mathematics instruction in kindergarten on the elementary school mathematics curriculum?

**ITEM 106 IS TO BE ANSWERED ONLY BY TEACHERS OF STUDENTS IN GRADES 5 AND 6.**

106. What information do you use to select students for Introduction to Algebra in grade 6?

**ITEMS 107 to 110 ARE TO BE ANSWERED ONLY BY TEACHERS OF INTRODUCTION TO ALGEBRA**

107. What percentage of your students in Introduction to Algebra continue with Algebra I in grade 7?

108. What information do you use to select students for Algebra I in grade 7?

109. What are the characteristics of students who are successful in Introduction to Algebra in grade 6?

110. When students are unsuccessful in Introduction to Algebra in grade 6, what are the major reasons?

111. Is there anything else that you would like to tell us about the County Mathematics Program?

**ANNE ARUNDEL COUNTY PUBLIC SCHOOLS**

**OFFICE OF RESEARCH**

**MATHEMATICS PROGRAM EVALUATION**

SURVEY OF MIDDLE/JUNIOR HIGH SCHOOL TEACHERS

Dear Middle/Junior High School Mathematics Teacher:

At the direction of the Superintendent of Schools and the Board of Education, the Office of Research is coordinating and conducting an evaluation of the kindergarten through grade twelve Mathematics Program. The purpose of the evaluation is to answer a series of questions about the mathematics curriculum, mathematics instruction, and students' performance in, attitudes about, and later success in mathematics. Some of the questions have been raised by mathematics teachers, as well as by the School Directors, the Coordinator of Mathematics, the School and Program Evaluation Committee, and mathematics department chairpersons. Your response to the survey is very important. Please take the time to complete the survey so that the responses of middle and junior high school teachers to the survey questions are represented in the evaluation final report.

Thank you for the time you give to complete this survey. Please return the survey and General Purpose Answer Sheet within seven (7) days by basket mail to the Office of Research.

**DIRECTIONS: Please respond to the items on this survey by marking your answers on a General Purpose Answer Sheet. Code each answer by darkening the bubble on the answer sheet that corresponds to the number of the survey item and letter of your response to that item. For example, if your response to item 1 (What is your current position?) is mathematics teacher (choice D), you will darken bubble 1D on the answer sheet.**

**Teachers: Please respond to the survey items with reference to the mathematics classes you teach this year.**

**Department Chairpersons: Please respond to the survey items with reference to the total mathematics program in the school.**

**When comments are asked for, they may be written directly on the survey and returned with your answer sheet. All survey responses are to be anonymous. Do not complete any of the sections of the answer sheet which request personal information (e.g., name, sex, birth date).**

**Code the grade or grades you teach mathematics by darkening the appropriate bubble(s) under GRADE or EDUC.**

Note: Principals, mathematics department chairpersons, mathematics teachers, and guidance counselors in elementary, middle, junior high, and senior high schools are being surveyed to gather information for the Mathematics Program Evaluation. Each survey asks some questions specific to the staff member and/or school level. Therefore, it is necessary to ask questions 1 and 2 to determine what staff member and what level of school each answer sheet represents.

**Professional Information**

1. What is your current position?
   A. Principal
   B. Assistant principal
   C. Mathematics department chairperson
   D. Mathematics teacher
   E. Guidance counselor
   F. Other (specify) _____

2. At what level are you currently employed?
   A. Elementary school
   B. Middle school
   C. Junior high school
   D. Senior high school

3. What teaching certificates do you currently hold? (Code all that apply.)
   A. Secondary mathematics (grades 5-12)
   B. Elementary (grades 1-6 plus middle school)
   C. Elementary (grades 1-6) mathematics (grades 7-9)
   D Early childhood
   E. Other (what area?) _____
   F. None

4. How long have you been teaching mathematics?
   A. 1 year or less
   B. 2 years
   C. 3 to 5 years
   D. 6 to 10 years
   E. More than 10 years

**Questions about the Mathematics Curriculum***

5. To what degree has the Anne Arundel County mathematics curriculum been implemented in the grades you teach?
   A. To a great degree
   B. To an adequate degree
   C. To a little degree
   D. Not at all

6. Does the mathematics curriculum match students' cognitive development in the grades or courses you teach?
   A. Yes
   B. No (why not?) _____
   _____
   C. I don't know

*The Mathematics Curriculum is defined as the Goals and Objectives for Mathematics, the Mathematics Scope and Sequence Chart, Unified Mathematics Booklets B, C & D, and course guides for Introduction to Algebra, Algebra I, Algebra II, and Fused Geometry.

7. Do the skills and content in the mathematics curriculum meet the diverse educational needs of students at the grade levels or in the courses you teach?
   A. Yes
   B. No (why not?) _____
   _____
   C. I don't know

8. Which of the following do you use in planning mathematics instruction? (Code all that you use.)
   A. Mathematics Goals and Objectives
   B. Mathematics Scope and Sequence Chart
   C. Unified Mathematics Booklets B, C & D
   D. Mathematics Elective Course Guides
   E. Mathematics textbooks
   F. Teacher's/students' backgrounds and interests
   G. Other (what?) _____

9. Is there any unnecessary duplication in the mathematics content from grade to grade or course to course?
   A. Yes (where?) _____
   _____
   B. No
   C. I don't know

10. Are the mathematics content and skills which you introduce reinforced in subsequent grades and/or courses?
    A. Yes
    B. No
    C. I don't know

11. Are there topics/skills omitted from earlier grades/courses which students need to know in the grades/courses that you teach?
    A. Yes (what are they?) _____
    _____
    B. No
    C. I don't know

12. Do you believe that you are well prepared to teach the mathematics grades/courses you are now teaching?
    A. Yes
    B. No (why not?) _____
    _____
    C. I don't know

13. Are you comfortable teaching the Anne Arundel County Mathematics Curriculum?
    A. Yes
    B. No (why not?) _____
    C. I don't know

**ITEMS 14 to 20: Listed below are the seven Unified Mathematics strands. Please indicate for each strand if the emphasis in the Scope and Sequence Charts and Unified Math Booklets is appropriate at the grade(s) you teach.**

14. Analysis of number and numeration systems
    A. There is too much emphasis of this strand.
    B. The emphasis of this strand is about right.
    C. There is too little emphasis of this strand.

15. Numeric and algebraic operations
    A. There is too much emphasis of this strand.
    B. The emphasis of this strand is about right.
    C. There is too little emphasis of this strand.

16. Graphic operations
    A. There is too much emphasis of this strand.
    B. The emphasis of this strand is about right.
    C. There is too little emphasis of this strand.

17. Geometry
    A. There is too much emphasis of this strand.
    B. The emphasis of this strand is about right.
    C. There is too little emphasis of this strand.

18. Measurement and probability
    A. There is too much emphasis of this strand.
    B. The emphasis of this strand is about right.
    C. There is too little emphasis of this strand.

19. Sets and logic
    A. There is too much emphasis of this strand.
    B. The emphasis of this strand is about right.
    C. There is too little emphasis of this strand.

20. Problem solving
    A. There is too much emphasis of this strand.
    B. The emphasis of this strand is about right.
    C. There is too little emphasis of this strand.

**Questions about Unified Mathematics Booklets and Course Guides**

21. Are the Unified Math Booklets and/or course guides that you use complete?
    A. Yes
    B. No
    C. I don't know

22. Are the Unified Math Booklets and/or course guides that you use clear?
    A. Yes
    B. No
    C. I don't know

23. How easy or difficult is it for you to teach mathematics using the Anne Arundel County Unified Math Booklets and course guides?
    A. Easy
    B. Neither easy nor difficult
    C. Difficult (why?) _____
    _____

24. Are the activities suggested in the Introduction to Algebra, Algebra I, Algebra II, and Fused Geometry course guides realistic in terms of what you can accomplish in your classroom?
    A. Yes
    B. No (why not?) _____
    _____
    C. I don't know
    D. I don't teach any of these courses.

25. Are the basic materials of instruction listed in the Unified Math Booklets and/or course guides that you use appropriate for the instructional activities you teach?
    A. Yes
    B. No (why not?) _____
    _____
    C. I don't know

26. Should the Unified Math Booklets and/or course guides be changed in any way to make them easier to use?
    A. Yes (how?)_____
    _____
    B. No
    C. I don't know

27. Would you like to have a curriculum guide for each grade level you teach?
    A. Yes
    B. No
    C. I don't know

28. Are County developed Unified Math Booklets and/or course guides available to you in sufficient supply?
    A. Yes
    B. No

**Questions about Materials of Instruction**

29. Do you have a basic textbook for each class/course you teach?
    A. Yes
    B. No

30. Do you have enough equipment to teach the mathematics curriculum?
    A. Yes
    B. No

31. Are the Anne Arundel County Unified Math Booklets and/or course guides useful when selecting the basic textbooks used in your school?
    A. Yes
    B. No (why not?) _____
    _____

32. Do the basic textbooks currently approved in mathematics correlate closely with the County curriculum?
    A. Yes
    B. No (why not?) _____
    _____

**Questions about Mathematics Instruction**

33. Do you know what mathematics skills/content are taught in the grades/courses which immediately precede the ones you teach?
    A. Yes
    B. No
    C. I don't know

34. Do you know what mathematics skills/content will be taught in the grades/courses which immediately follow the ones you teach?
    A. Yes
    B. No
    C. I don't know

ITEMS 35 to 39: How often do you use each of the following grouping strategies when teaching mathematics?

35. Total class presentations or discussions
    A. Daily
    B. Two to three times a week
    C. About once a week
    D. About once or twice a month
    E. Less than once a month
    F. Never

36. Discussions, group work, or projects in two or more groups
    A. Daily
    B. Two to three times a week
    C. About once a week
    D. About once or twice a month
    E. Less than once a month
    F. Never

37. Independent work
    A. Daily
    B. Two to three times a week
    C. About once a week
    D. About once or twice a month
    E. Less than once a month
    F. Never

38. Teacher-student work on a one-to-one basis
    A. Daily
    B. Two to three times a week
    C. About once a week
    D. About once or twice a month
    E. Less than once a month
    F. Never

39. Other (specify) _____
    A. Daily
    B. Two to three times a week
    C. About once a week
    D. About once or twice a month
    E. Less than once a month
    F. Never

ITEMS 40 to 56: How often do you use each of following when teaching mathematics?

40. Lectures
    A. Daily
    B. Two to three times a week
    C. About once a week
    D. About once or twice a month
    E. Less than once a month
    F. Never

41. Discussion
    A. Daily
    B. Two to three times a week
    C. About once a week
    D. About once or twice a month
    E. Less than once a month
    F. Never

42. Drill
    A. Daily
    B. Two to three times a week
    C. About once a week
    D. About once or twice a month
    E. Less than once a month
    F. Never

43. Teacher demonstrations
    A. Daily
    B. Two to three times a week
    C. About once a week
    D. About once or twice a month
    E. Less than once a month
    F. Never

44. Written work (dittos, work sheets)
   A. Daily
   B. Two to three times a week
   C. About once a week
   D. About once or twice a month
   E. Less than once a month
   F. Never

45. Board work
   A. Daily
   B. Two to three times a week
   C. About once a week
   D. About once or twice a month
   E. Less than once a month
   F. Never

46. Student presentations
   A. Daily
   B. Two to three times a week
   C. About once a week
   D. About once or twice a month
   E. Less than once a month
   F. Never

47. Learning stations
   A. Daily
   B. Two to three times a week
   C. About once a week
   D. About once or twice a month
   E. Less than once a month
   F. Never

48. Stimulations and games
   A. Daily
   B. Two to three times a week
   C. About once a week
   D. About once or twice a month
   E. Less than once a month
   F. Never

49. Discovery learning
   A. Daily
   B. Two to three times a week
   C. About once a week
   D. About once or twice a month
   E. Less than once a month
   F. Never

50. Inquiry or problem solving
   A. Daily
   B. Two to three times a week
   C. About once a week
   D. About once or twice a month
   E. Less than once a month
   F. Never

51. Television, film, or other media presentation
   A. Daily
   B. Two to three times a week
   C. About once a week
   D. About once or twice a month
   E. Less than once a month
   F. Never

52. Administering tests and quizzes
   A. Daily
   B. Two to three times a week
   C. About once a week
   D. About once or twice a month
   E. Less than once a month
   F. Never

53. Tutoring students outside of class
   A. Daily
   B. Two to three times a week
   C. About once a week
   D. About once or twice a month
   E. Less than once a month
   F. Never

54. Assigning homework to be done in class
   A. Daily
   B. Two to three times a week
   C. About once a week
   D. About once or twice a month
   E. Less than once a month
   F. Never

55. Assigning homework to be done outside of class
   A. Daily
   B. Two to three times a week
   C. About once a week
   D. About once or twice a month
   E. Less than once a month
   F. Never

56. Other (specify) _____
   _____
   A. Daily
   B. Two to three times a week
   C. About once a week
   D. About once or twice a month
   E. Less than once a month
   F. Never

57. About how long do you estimate it requires students to complete homework assigned to be done outside of class?
   A. One to 15 minutes
   B. 16 to 30 minutes
   C. 31 to 45 minutes
   D. 46 to 60 minutes
   E. More than 60 minutes

**Questions about the Mathematics Gifted/Talented Program**

58. Which of the following most accurately describes how students are selected for gifted/talented program offerings in this school?
   A. Students are identified and selected separately in each subject area
   B. Students are identified and selected globally (i.e., for participation in all gifted/talented programs offered at this school)
   C. Other (specify) _____
   _____

**ITEMS 59 and 60 are to be answered only by teachers of the Mathematics Gifted/Talented Program.**

59. Do the selection criteria for the gifted/talented mathematics program seem to correlate with high mathematics aptitudes?
   A. Yes
   B. No (why not?) _____
   _____
   C. I don't know

60. Does the mathematics program for gifted/talented students differ substantially from the regular mathematics program in this school?
    A. Yes
    B. No (why not?) _____
    _____
    C. I don't know

**Questions about Offering Algebra I in Grade 7**

**ITEM 61: Teachers of Introduction to Algebra in grade 6 only.**

61. What percentage of your students in Introduction to Algebra in grade 6 continue with Algebra I?
    A. Less than 10%
    B. 10 to 19%
    C. 20 to 29%
    D. 30 to 39%
    E. 40 to 49%
    F. 50 to 59%
    G. 60 to 69%
    H. 70 to 79%
    I. 80 to 89%
    J. 90% or more

**ITEM 62: Teachers of Algebra I in grade 7 only**

62. Does Introduction to Algebra adequately prepare students for Algebra I?
    A. Yes
    B. No (why not?) _____
    _____
    C. I don't know

63. Should Algebra I be offered in Grade 7?
    A. Yes
    B. No (why not?) _____
    _____
    C. I don't know

64. When a student takes Algebra I in grade 7, what is the best sequence of courses for grades 8 and 9?
    A. Fused Geometry then Algebra II
    B. Algebra II then Fused Geometry
    C. Other (specify) _____

**Questions about Instructional Assistance**

ITEMS 65 to 75: The following are the various ways in which instructional assistance can be provided to help teachers implement and/or teach the mathematics program. Please indicate whether or not you have received each of the following types of assistance and how helpful this assistance has been.

65. Working with the mathematics department chairperson
    A. I have not received this type of assistance.
    B. I have received this type of assistance; it has been helpful.
    C. I have received this type of assistance; it has <u>not</u> been helpful.

66. Working with the principal
    A. I have not received this type of assistance.
    B. I have received this type of assistance; it has been helpful.
    C. I have received this type of assistance; it has <u>not</u> been helpful.

67. Working with an assistant principal or administrative intern
    A. I have not received this type of assistance.
    B. I have received this type of assistance; it has been helpful.
    C. I have received this type of assistance; it has <u>not</u> been helpful.

68. Working with another mathematics teacher
    A. I have not received this type of assistance.
    B. I have received this type of assistance; it has been helpful.
    C. I have received this type of assistance; it has <u>not</u> been helpful.

69. Enrolling in graduate courses related to teaching mathematics
    A. I have not received this type of assistance.
    B. I have received this type of assistance; it has been helpful.
    C. I have received this type of assistance; it has <u>not</u> been helpful.

70. Enrolling in county workshops related to teaching mathematics
    A. I have not received this type of assistance.
    B. I have received this type of assistance; it has been helpful.
    C. I have received this type of assistance; it has <u>not</u> been helpful.

71. Working with the Coordinator of Mathematics
    A. I have not received this type of assistance.
    B. I have received this type of assistance; it has been helpful.
    C. I have received this type of assistance; it has <u>not</u> been helpful.

72. Working with resource teachers
    A. I have not received this type of assistance.
    B. I have received this type of assistance; it has been helpful.
    C. I have received this type of assistance; it has <u>not</u> been helpful.

73. Using County developed curriculum materials
    A. I have not used this type of material.
    B. I have used this type of material; it has been helpful.
    C. I have used this type of material; it has <u>not</u> been helpful.

74. Using professional journals
    A. I have not used this type of material.
    B. I have used this type of material; it has been helpful.
    C. I have used this type of material; it has <u>not</u> been helpful.

75. Other (specify) _____
    A. I have not received this type of assistance.
    B. I have received this type of assistance; it has been helpful.
    C. I have received this type of assistance; it has <u>not</u> been helpful.

76. Are there enough inservice opportunities available to you to ensure that you can teach the mathematics curriculum effectively?
    A. Yes
    B. No (What kinds are needed?) _____
    _____
    C. I don't know

**Questions about Student Assessment**

ITEMS 77 to 86: Which of the following do you use at the <u>beginning</u> of a course to diagnose students' instructional needs in mathematics and to group students for mathematics instruction?

77. Norm referenced standardized tests
A. Yes
B. No

78. Published criterion referenced tests
A. Yes
B. No

79. Teacher made tests
A. Yes
B. No

80. Tests in textbooks or teacher's guides
A. Yes
B. No

81. Informal assessments or inventories
A. Yes
B. No

82. Information in cumulative records
A. Yes
B. No

83. Anecdotal records
A. Yes
B. No

84. Individual Mathematics Records
A. Yes
B. No

85. Class records
A. Yes
B. No

86. Other (specify) _____
A. Yes
B. No

87. When a student enrolls in a mathematics course/class you teach, do you check to insure that his/her placement is appropriate?
A. Yes (how?) _____
B. No

88. Do you have a choice in what mathematics class/course a student is placed?
A. Yes
B. No

89. Can you make adjustments in a student's placement other than at the end of the semester?
A. Yes
B. No.

ITEMS 90 to 97: Which of the following do you use at the end of a course or year to determine a student's mastery?

90. Norm referenced standardized tests
A. Yes
B. No

91. Published criterion referenced tests
A. Yes
B. No

92. Teacher made tests
A. Yes
B. No

93. Tests in textbooks or teacher's guides
A. Yes
B. No

94. Informal assessments or inventories
A. Yes
B. No

95. Individual Mathematics Records
A. Yes
B. No

96. Class records
A. Yes
B. No

97. Other (specify) _____
A. Yes
B. No

**Questions about Career Education in Mathematics**

98. Are students made aware of the mathematics requirements for the career opportunities in which they are interested?
A. Yes (answer item 99)
B. No (go to item 100)

99. At what grade level do students know the mathematics requirements for the career opportunities in which they are interested?
A. Grade 6
B. Grade 7
C. Grade 8
D. Grade 9
E. Other (when?) _____
F. I dont' know

**Questions about Professional Organizations**

To what professional organizations of mathematics educators do you belong?

100. National Council for Teachers of Mathematics
A. Yes
B. No.

101. Maryland Council for Teachers of Mathematics
A. Yes
B. No.

102. Other (specify) _____
A. Yes
B. No

103. Has your school been part of the Instructional Leadership Project?
A. Yes, and this is the first year
B. Yes, and this is the second year
C. Yes, and this is the third year
D. Yes, and this is the fourth year
E. No
F. I don't know

DIRECTIONS: THE FINAL QUESTIONS ARE OPEN-ENDED. PLEASE ANSWER EACH QUESTION AS BRIEFLY AS POSSIBLE. IF YOU NEED MORE ROOM TO ANSWER A QUESTION THAN IS PROVIDED ON THESE PAGES, PLEASE FEEL FREE TO CONTINUE ON AN ADDITIONAL SHEET OF PAPER.

104. Are microprocessors available for mathematics instruction? If so, how are you using microprocessors in mathematics instruction?

105. What types of assistance do you need to help increase the effectiveness of mathematics instruction?

106. Do you maintain the Individual Mathematics Record? How do you use the information in it? How can the Individual Mathematics Record best be used?

**ITEMS 107 to 109: To be answered only by teachers of Introduction to Algebra in grade 6.**

107. What information do you use to select students for Algebra I in grade 7?

108. What are the characteristics of students who are successful in Introduction to Algebra?

109. When students are unsuccessful in Introduction to Algebra in grade 6, what are the major reasons?

**ITEMS 110 to 112: To be answered only by teachers of Algebra I in grade 7.**

110. What are the characteristics of students who succeed in Algebra I in grade 7?

111. When students are unsuccessful in Algebra I in grade 7, what are the major reasons?

112. What was the attrition rate in Algebra I in grade 7 this year?

113. What should the instructional sequence be for students who are unsuccessful in Introduction to Algebra in grade 6?

114. What should the instructional sequence be for students who are unsuccessful in Algebra I in grade 7?

115. How well do students who have completed Algebra I in grade seven achieve in later mathematics courses?

116. If this school has been part of the Instructional Leadership Project, what has its impact been on mathematics instruction?

117. Is there anything else that you have not previously written that you would like us to know about the Mathematics Program?

**ANNE ARUNDEL COUNTY PUBLIC SCHOOLS**

**OFFICE OF RESEARCH**

**MATHEMATICS PROGRAM EVALUATION**

SURVEY OF SENIOR HIGH SCHOOL TEACHERS

Dear Senior High School Mathematics Teacher:

At the direction of the Superintendent of Schools and the Board of Education, the Office of Research is coordinating and conducting an evaluation of the kindergarten through grade twelve Mathematics Program this school year. The purpose of the evaluation is to answer a series of questions about the mathematics curriculum, mathematics instruction, and students' performance in, attitudes about, and later success in mathematics. Some of the questions have been raised by mathematics teachers, as well as by the School Directors, the Coordinator of Mathematics, the School and Program Evaluation Committee, and mathematics department chairpersons. Your response to the survey is very important. Please take time to complete the survey so that the responses of senior high mathematics teachers to the survey questions are represented in the evaluation final report.

Thank you for the time you give to complete the survey. Please return the survey and General Purpose Answer Sheet within seven (7) days by basket mail to the Office of Research.

**DIRECTIONS: Please respond to the items on this survey by marking your answers on a General Purpose Answer Sheet. Code each answer by darkening the bubble on the answer sheet that corresponds to the number of the survey item and letter of your response to that item. For example, if your response to item 1 (What is your current position?) is mathematics teacher (choice D), you will darken bubble 1D on the answer sheet.**

**Teachers: Please respond to the survey items with reference to the mathematics courses you teach this year.**

**Department Chairpersons: Please respond to the survey items with reference to the total mathematics program in the school.**

**When comments are asked for, they may be written directly on the survey and returned with your answer sheet. All survey responses are to be anonymous. Do not complete any of the sections of the answer sheet which request personal information (e.g., name, sex, birth date).**

**Code the grade or grades you teach mathematics by darkening the appropriate bubble(s) under GRADE or EDUC.**

Note: Principals, mathematics department chairpersons, mathematics teachers, and guidance counselors in elementary, middle, junior high, and senior high schools are being surveyed to gather information for the Mathematics Program Evaluation. Each survey asks some questions specific to the staff member and/or school level. Therefore, it is necessary to ask questions 1 and 2 to determine what staff member and what level of school each answer sheet represents.

**Professional Information**

1. What is your current position?
   A. Principal
   B. Assistant principal
   C. Mathematics department chairperson
   D. Mathematics teacher
   E. Guidance counselor
   F. Other (specify) _____

2. At what level are you currently employed?
   A. Elementary school
   B. Middle school
   C. Junior high school
   D. Senior high school

3. What teaching certificate do you currently hold? (Code all that apply)
   A. Secondary Mathematics (grades 5-12)
   B. Elementary (grades 1-6 plus middle school)
   C. Elementary (grades 1-6), mathematics (grades 7-9)
   D. Early Childhood
   E. Other (what area?) _____
   F. None

4. How long have you been teaching mathematics?
   A. 1 year or less
   B. 2 years
   C. 3 to 5 years
   D. 6 to 10 years
   E. More than 10 years

**Questions About The Mathematics Curriculum***

5. To what degree has the Anne Arundel County mathematics curriculum been implemented in the courses you teach?
   A. To a great degree
   B. To an adequate degree
   C. To a little degree
   D. Not at all

6. Does the mathematics curriculum match students' cognitive development in courses you teach?
   A. Yes
   B. No (why not?) _____
   _____
   C. I don't know

*The Mathematics Curriculum is defined as the Goals and Objections for Mathematics, Unified Mathematics Booklets B, C, D, and all elective course guides.

7. Do the skills and content in the mathematics curriculum meet the diverse educational needs of students in the courses you teach?
   A. Yes
   B. No (why not?) _____
   _____
   C. I don't know

8. Are the number of courses adequate to meet the diverse educational needs of students in grades 9 through 12?
   A. Yes
   B. No (why not?) _____
   _____
   C. I don't know

9. Which of the following do you use in planning mathematics instruction? (Check all that you use.)
   A. Mathematics Goals and Objectives
   B. Mathematics Scope and Sequence Chart
   C. Unified Mathematics Booklets B, C, or D
   D. Mathematics Elective Course Guides
   E. Mathematics textbooks
   F. Teacher's/students' backgrounds and interests
   G. Other (what?) _____
   _____

10. Is there any unnecessary duplication in the mathematics content from course to course?
   A. Yes (where?) _____
   _____
   B. No
   C. I don't know

11. Are the mathematics content and skills which you introduce reinforced in subsequent courses?
   A. Yes
   B. No
   C. I don't know

12. Are there topics/skills omitted from earlier courses which students need to know in the courses that you teach?
   A. Yes (what are they?) _____
   _____
   B. No
   C. I don't know

13. Do you believe you are well prepared to teach the mathematics courses you are now teaching?
   A. Yes
   B. No (why not?) _____
   _____
   C. I don't know

14. Are you comfortable teaching the Anne Arundel County Mathematics Curriculum?
   A. Yes
   B. No (why not?) _____
   _____
   C. I don't know

**Questions About the Unified Mathematics Booklets and Course Guides.**

15. Are the course guides that you use complete?
   A. Yes
   B. No (why not?) _____
   _____
   C. I don't know

16. Are the course guides that you use clear?
   A. Yes
   B. No (why not?) _____
   _____
   C. I don't know

17. How easy or difficult is it for you to teach mathematics using the Anne Arundel County course guides?
   A. Easy
   B. Neither easy nor difficult
   C. Difficult (why?) _____
   _____

18. Are the activities suggested in the course guides you use realistic in terms of what you can accomplish in your classroom?
   A. Yes
   B. No (why not?) _____
   _____
   C. I don't know

19. Are the basic materials of instruction listed in the course guides you use appropriate for the instructional activities you teach?
   A. Yes
   B. No (why not?) _____
   _____
   C. I don't know

20. Should the mathematics guides be changed in any way to make them easier to use?
   A. Yes (how?) _____
   _____
   B. No

21. Are Anne Arundel County developed mathematics course guides available to you in sufficient supply?
   A. Yes
   B. No

**Questions About Materials of Instruction.**

22. Do you have a basic textbook for each course you teach?
   A. Yes
   B. No

23. Do you have enough equipment to teach the mathematics curriculum?
   A. Yes
   B. No

24. Are the Anne Arundel County course guides useful when selecting basic textbooks used in your school?
   A. Yes
   B. No (why not?) _____
   _____

25. Do the basic textbooks used in your school correlate closely with the County curriculum?
   A. Yes
   B. No (why not?) _____
   _____

**Questions About Mathematics Instruction**

26. Do you know what mathematics skills/content are taught in the courses which immediately precede the ones you teach?
   A. Yes
   B. No
   C. I don't know

27. Do you know what mathematics skills/content will be taught in the courses which immediately follow the ones you teach?
    A. Yes
    B. No
    C. I don't know

ITEMS 28 to 32: How often do you use each of the following grouping strategies when teaching mathematics?

28. Total class presentations or discussions
    A. Daily
    B. Two to three times a week
    C. About once a week
    D. About once or twice a month
    E. Less than once a month
    F. Never

29. Discussions, group work, or projects in two or more groups
    A. Daily
    B. Two to three times a week
    C. About once a week
    D. About once or twice a month
    E. Less than once a month
    F. Never

30. Independent work
    A. Daily
    B. Two to three times a week
    C. About once a week
    D. About once or twice a month
    E. Less than once a month
    F. Never

31. Teacher-student work on a one-to-one basis
    A. Daily
    B. Two to three times a week
    C. About once a week
    D. About one or twice a month
    E. Less than once a month
    F. Never

32. Other (specify) _____
    A. Daily
    B. Two to three times a week
    C. About once a week
    D. About once or twice a month
    E. Less than once a month
    F. Never

ITEMS 33 to 49: How often do you use each of following when teaching mathematics?

33. Lectures
    A. Daily
    B. Two to three times a week
    C. About once a week
    D. About once or twice a month
    E. Less than once a month
    F. Never

34. Discussion
    A. Daily
    B. Two to three times a week
    C. About once a week
    D. About once or twice a month
    E. Less than once a month
    F. Never

35. Drill
    A. Daily
    B. Two to three times a week
    C. About once a week
    D. About once or twice a month
    E. Less than once a month
    F. Never

36. Teacher demonstrations
    A. Daily
    B. Two to three times a week
    C. About once a week
    D. About once or twice a month
    E. Less than once a month
    F. Never

37. Written work (dittos, work sheets)
    A. Daily
    B. Two to three times a week
    C. About once a week
    D. About once or twice a month
    E. Less than once a month
    F. Never

38. Board work
    A. Daily
    B. Two to three times a week
    C. About once a week
    D. About once or twice a month
    E. Less than once a month
    F. Never

39. Student presentations
    A. Daily
    B. Two to three times a week
    C. About once a week
    D. About once or twice a month
    E. Less than once a month
    F. Never

40. Learning stations
    A. Daily
    B. Two to three times a week
    C. About once a week
    D. About once or twice a month
    E. Less than once a month
    F. Never

41. Simulations and games
    A. Daily
    B. Two to three times a week
    C. About once a week
    D. About once or twice a month
    E. Less than once a month
    F. Never

42. Discovery learning
    A. Daily
    B. Two to three times a week
    C. About once a week
    D. About once or twice a month
    E. Less than once a month
    F. Never

43. Inquiry or problem solving
   A. Daily
   B. Two to three times a week
   C. About once a week
   D. About once or twice a month
   E. Less than once a month
   F. Never

44. Television, film, or other media presentation
   A. Daily
   B. Two to three times a week
   C. About once a week
   D. About once or twice a month
   E. Less than once a month
   F. Never

45. Administering tests and quizzes
   A. Daily
   B. Two to three times a week
   C. About once a week
   D. About once or twice a month
   E. Less than once a month
   F. Never

46. Tutoring students outside of class
   A. Daily
   B. Two to three times a week
   C. About once a week
   D. About once or twice a month
   E. Less than once a month
   F. Never

47. Assigning homework to be done in class
   A. Daily
   B. Two to three times a week
   C. About once a week
   D. About once or twice a month
   E. Less than once a month
   F. Never

48. Assigning homework to be done outside of class
   A. Daily
   B. Two to three times a week
   C. About once a week
   D. About once or twice a month
   E. Less than once a month
   F. Never

49. Other (specify) _____
   A. Daily
   B. Two to three times a week
   C. About once a week
   D. About once or twice a month
   E. Less than once a month
   F. Never

50. About how long do you estimate it requires students to complete homework assigned to be done outside of class?
   A. One to 15 minutes
   B. 16 to 30 minutes
   C. 31 to 45 minutes
   D. 46 to 60 minutes
   E. More than 60 minutes

**Questions About the Gifted/Talented Program**

51. Which of the following most accurately describes how students are selected for gifted/talented program offerings in this school?
   A. Students are identified and selected separately in each subject area
   B. Students are identified and selected globally (i.e., for participation in all gifted/talented programs offered at this school)
   C. Other (specify) _____
      _____

52. What kinds of courses do you counsel highly able mathematics students to schedule?
   A. Advanced Placement Calculus
   B. Elective Mathematics Courses Other than AP Calculus (What are they?)_____
      _____

53. Do the selection criteria for advanced mathematics courses seem to correlate with high mathematics aptitudes?
   A. Yes
   B. No (why not?) _____
      _____
   C. I don't know

**Questions About Instructional Assistance**

ITEMS 54 to 64: Listed below are the various ways in which instructional assistance can be provided to help teachers implement and/or teach the mathematics program. Please indicate whether or not you have received each of the following types of assistance and how helpful this assistance has been.

54. Working with the mathematics department chairperson
   A. I have not received this type of assistance.
   B. I have received this type of assistance; it has been helpful.
   C. I have received this type of assistance; it has not been helpful.

55. Working with the principal
   A. I have not received this type of assistance.
   B. I have received this type of assistance; it has been helpful.
   C. I have received this type of assistance; it has not been helpful.

56. Working with an assistant principal or administrative intern.
   A. I have not received this type of assistance.
   B. I have received this type of assistance; it has been helpful.
   C. I have received this type of assistance; it has not been helpful.

57. Working with another mathematics teacher
   A. I have not received this type of assistance.
   B. I have received this type of assistance; it has been helpful.
   C. I have received this type of assistance; it has not been helpful.

58. Enrolling in graduate courses related to teaching mathematics
   A. I have not received this type of assistance.
   B. I have received this type of assistance; it has been helpful.
   C. I have received this type of assistance; it has not been helpful.

59. Enrolling in county workshops related to teaching mathematics
   A. I have not received this type of assistance.
   B. I have received this type of assistance; it has been helpful.
   C. I have received this type of assistance; it has not been helpful.

60. Working with the Coordinator of Mathematics
   A. I have not received this type of assistance.
   B. I have received this type of assistance; it has been helpful.
   C. I have received this type of assistance; it has not been helpful.

61. Working with resource teachers
   A. I have not received this type of assistance.
   B. I have received this type of assistance; it has been helpful.
   C. I have received this type of assistance; it has not been helpful.

62. Using County developed curriculum materials
   A. I have not used this type of material.
   B. I have used this type of material; it has been helpful.
   C. I have used this type of material; it has not been helpful.

63. Using professional journals
   A. I have not used this type of material.
   B. I have used this type of material; it has been helpful.
   C. I have used this type of material; it has not been helpful.

64. Other (specify) _____
   A. I have not received this type of assistance.
   B. I have received this type of assistance; it has been helpful.
   C. I have received this type of assistance; it has not been helpful.

65. Are there enough inservice opportunities available to you to ensure that you can teach the mathematics curriculum effectively?
   A. Yes
   B. No. (What Kinds are Needed?) _____
   C. I don't know

**Questions About Student Assessment**

ITEMS 66 to 75: Which of the following do you use at the beginning of a course to diagnose students' instructional needs in mathematics and to group students for instruction?

66. Norm referenced standardized tests
   A. Yes
   B. No

67. Published criterion referenced tests
   A. Yes
   B. No

68. Teacher made tests
   A. Yes
   B. No

69. Tests in textbooks or teacher's guides
   A. Yes
   B. No

70. Informal assessments or inventories
   A. Yes
   B. No

71. Information in cumulative records
   A. Yes
   B. No

72. Anecdotal records
   A. Yes
   B. No

73. Individual Mathematics Records
   A. Yes
   B. No

74. Class Records
   A. Yes
   B. No

75. Other (specify) _____
   A. Yes
   B. No

76. When a student enrolls in a mathematics course you teach, do you check to insure that his/her placement is appropriate?
   A. Yes
   B. No

77. Do you have a choice in what mathematics course or level a student is placed?
   A. Yes
   B. No

78. Can you make adjustments in a student's placement other than at the end of a semester?
   A. Yes
   B. No

ITEMS 79 to 86: Which of the following do you use at the end of a course or year to determine a student's mastery?

79. Norm referenced standardized tests
    A. Yes
    B. No

80. Published criterion referenced tests
    A. Yes
    B. No

81. Teacher made tests
    A. Yes
    B. No

82. Tests in textbooks or teacher's guides
    A. Yes
    B. No

83. Informal assessments or inventories
    A. Yes
    B. No

84. Individual Mathematics Records
    A. Yes
    B. No

85. Class Records
    A. Yes
    B. No

86. Other (specify) _____
    A. Yes
    B. No

**Questions About Career Education in Mathematics**

87. Are students made aware of the mathematics requirements for the career opportunities in which they are interested?
    A. Yes (Go to Item 88)
    B. No (Go to Item 89)

88. At what grade level do students know the mathematics requirements for the career opportunities in which they are interested?
    A. Grade 9  C. Grade 11  E. Other (when?) _____
    B. Grade 10  D. Grade 12  F. I don't know

**Questions About Offering Algebra I in Grade 7**

89. Should Algebra I be offered in grade 7?
    A. Yes
    B. No (why not?) _____
    _____
    C. I don't know

90. When a student takes Algebra I in grade 7, what is the best sequence of courses for grades 8 and 9?
    A. Fused Geometry then Algebra II
    B. Algebra II then Fused Geometry
    C. Other (Specify) _____

**Questions About Unified Mathematics in Grades 9-12**

91. Are there any differences in Unified Math in grades 9 through 12 as the courses are implemented?
    A. Yes
    B. No
    C. I don't know

92. How are students assigned to Unified Math in grades 9 through 12?
    A. By grade level
    B. By ability level
    C. By grade and ability level
    D. Other (specify) _____ _____
    _____
    E. I don't know

93. Do you teach Unified Mathematics to any ungraded classes? (e.g., Unified Mathematics to grades 9-10 together)?
    A. Yes
    B. No

**Questions About Other Topics**

94. What is your opinion about increasing the number of required mathematics credits for graduation to three?
    A. Three credits are too low (How many credits should be required?) _____
    B. Three credits are about right
    C. Three credits are too high. (How many credits should be required?) _____

95. Do you believe that students enrolled in trade programs at Vo-Tech Centers should receive an applied mathematics credit toward graduation upon satisfactorily completing two years of a trade program?
    A. Yes
    B. No

96. Has your school been part of the Instructional Leadership Project?
    A. Yes, and this is the first year
    B. Yes, and this is the second year
    C. Yes, and this is the third year
    D. Yes, and this is the fourth year
    E. No
    F. I don't know

**Questions About Professional Organizations**

To what professional organizations of mathematics educators do you belong?

97. National Council for Teachers of Mathematics
    A. Yes
    B. No

98. Maryland Council for Teachers of Mathematics
    A. Yes
    B. No

99. Other (specify) _____
    _____
    A. Yes
    B. No

DIRECTIONS: THE FINAL QUESTIONS ARE OPEN-ENDED. PLEASE ANSWER EACH QUESTION AS BRIEFLY AS POSSIBLE. IF YOU NEED MORE ROOM TO ANSWER A QUESTION THAN IS PROVIDED ON THESE PAGES, PLEASE FEEL FREE TO CONTINUE ON AN ADDITIONAL SHEET OF PAPER.

100. Are microprocessors available for mathematics instruction in your school? If so, how are you using microprocessors in mathematics instruction?

101. What types of assistance do you need to help increase the effectiveness of mathematics instruction?

102. How are students selected for AP Calculus?

103. What should the instructional sequence be for students who are unsuccessful in Algebra I in grade 7?

104. How well do students who have completed Algebra I in grade seven achieve in later mathematics courses?

105. What are the characteristics of students who are successful in high school academic courses?

106. What are the reasons students experience failure in high school academic courses?

107. What is the most appropriate sequence of mathematics courses for students in grades 9 through 12? (You may wish to answer this question generally or with specific reference to an academic, vocational, business education, or general high school program.)

108. If this school is part of the Instructional Leadership Project, what has its impact been on mathematics instruction?

109. Is there anything else that you haven't previously written that you would like us to know about the Mathematics Program?

Exhibit #8B

**memo**

ANNE ARUNDEL COUNTY PUBLIC SCHOOLS

| | |
|---|---|
| Date: June 17, 1985 | Filing Code: 3400 |

To: Board of Education Members

From: Miss C. Campbell, Coordinator of Mathematics

Subject: Mathematics Program Evaluation: Recommendations

cc:

Instructions:

Route To:

Reply To:

By Date:

Destroy After:

*Read and Initial*

**I. Problem:**

Periodically, each major discipline in Anne Arundel County Public Schools is chosen for an evaluation. The discipline of mathematics was selected, primarily for three major reasons, which in themselves naturally necessitated that the curriculum be examined in detail.

1. Functional Mathematics competency testing.
2. The requirement of three mathematics credits for all students.
3. Need to reflect current trends and appropriate teaching techniques within the curriculum.

**II. Background:**

Over the past two years, the Mathematics Program Evaluation has been conducted by the Department of Research and Evaluation. The Final Report was presented to the Board of Education on March 18, 1985. Copies of this report have been shared with all principals and school staffs.

Throughout and prior to this evaluation, I have worked closely with secondary mathematics department chairpersons and various individual school staffs as we addressed areas of concern reflected in this study and in my recommendations. I have met frequently with the various principals' groups to keep them involved, informed, and to obtain their input as the time approached for making our final recommendations.

Additionally, the recommendations were shared with all Citizen Advisory Councils, the President of the County Council of Parent Teacher Associations, and Chesapeake Regional Association of Student Councils.

The recommendations which follow were shared with all aforementioned groups on April 12, 1985, for the purpose of obtaining reactions (See Reaction Sheet - Attachment A). The responses which were received reflect strong support for all the recommendations. (See Reaction Sheet Summary, Attachment B.)



1800/1 (Rev. 5/82)

III. **Recommendations:**

**CURRICULUM**

1. Replace the Unified Mathematics titles (Grades 9-12) with content-descriptive course titles, with separate curriculum guides to be developed for each course. (See Suggested Sequences... General Student-Attachment D.)

Supportive rationale:

The general mathematics courses at the high school level vary significantly in content and structure from school to school. There is a definite need for additional direction and structure to be given to the program with supporting curriculum guides being provided to teachers. The guides would avoid much unnecessary overlap of content which exists in the current program structure, provide motivational approaches to the study of mathematics, and largely, provide all teachers with the expectancies for the particular course.

The existing title structure allows for one credit to be awarded at each grade level, i.e., Unified Mathematics 10 (D1000). However, the content associated with a particular course should not be grade specific. Providing appropriate content for three mathematics credits, especially for remedial students who need "appropriate assistance," necessitates additional flexibility in course offerings. This desired flexibility, which is very difficult to attain in our current title structure, would be provided with content-descriptive titles.

The proposal introduces only one additional level of instruction beyond what is common practice within the high schools. This is the remedial level available for 11th graders, Fundamentals of Mathematics II. There is no increase in the number of core offerings being recommended. Therefore, we see scheduling being facilitated rather than hampered with the built-in flexibility in course offerings and selections.

Copies of two curriculum guides, Mathematics 9 and Fundamentals of Mathematics I, are submitted for your approval (Attachments F & G.) Copies of the rough drafts have been provided to teachers for use under the Unified Titles. (Appropriate assistance for students failing the Maryland Functional Mathematics Test had to be in place in fall of 1984; therefore, Fundamentals of Mathematics I was developed and distributed.)

We recommend that the new titles be in effect for the Fall Semester of 1986. (New Course Description Booklet being published during fall of 1985.)

The proposed time line for development of remaining course guides:

**Summer, 1985**
Fundamentals of Mathematics II
Consumer Mathematics

**Summer, 1986**
Pre-Algebra
Integrated Topics of Mathematics

2. Develop curriculum guides for academic courses. Courses for which guides have not been written have been reduced to:

   Probability and Statistics
   Trigonometry
   Calculus (AB/BC)
   (Listing is in priority order for development).

Continue the academic program and sequences as shown on Attachment E, Suggested Sequences for Mathematics Programs.

Supportive rationale:

The ultimate goal is to have a curriculum guide for each course offering. However, we do not see a "pressing need" for development of these specific academic course guides. Therefore, they are lower on the priority list than those for the general courses.

We think the academic program and sequences are working well and see no need for change.

3. Revise the Computer Mathematics Curriculum Guides to reflect an emphasis on mathematics content/applications instead of computer literacy and programming skills. Timing for this development, naturally, must be coordinated with program development for computer science in general.

   We strongly recommend that action soon be taken to separate general computer science curriculum from mathematics curriculum.

Supportive rationale:

Currently the students who are taking Computer Mathematics I, Computer Mathematics II, and/or Advanced Computer Science are receiving mathematics credit for content that is computer science in nature. The emphasis is in programming in BASIC, FORTRAN, or PASCAL. We recognize that although logical thinking is very much a part of these classes, a credit in mathematics should reflect "mathematics content." The general programming courses should receive elective rather than mathematics credit.

4a. Revise the Scope and Sequence Chart for Mathematics, Grades K-8.

b. Develop separate curriculum guides for each grade level using the standard four column format including objectives, content, suggested activities and resources.

Supportive rationale:

The A, B, C Curriculum Guides were developed with content objectives being stated, with each booklet covering a span of three years. We would propose to delineate more specifically appropriate objectives for each grade level using the three step model:

Objective readiness (at a particular grade level).
Objective content (to be taught the following year).
Objective reinforcement (as many years as appropriate).

The elementary curriculum guides were developed in the early 70's and have not undergone any revisions. They need to be updated and expanded to reflect current trends in mathematics, particularly the impact of technology on mathematics instruction. Naturally, the Scope and Sequence Chart and curriculum guides will parallel each other - hence the proposed revision of Scope and Sequence and the development of curriculum guides for each grade level.

The content of the curriculum guides will be congruous with our approved textbook series, thus eliminating the need for any school to purchase additional texts. The proposed time line for development of K-2 is the summer of 1985. The time line for development of further grade levels is to be worked out with the Director of Curriculum.

5a. Eliminate use of current Mathematics Inventory Record in mathematics instruction. Incorporate appropriate record keeping sheets for each unit within written curriculum guides. Continue to review future possibilities of record keeping procedures with micro-computers within a given school.

b. Form a committee of teachers and principals to review the need for an individual mathematics articulation card that would more readily serve an instructional purpose.

Supportive rationale:

I rarely find in my school visitations instances where the Mathematics Inventory Record is used for planning instruction, either on a short term or year-to-year basis. Elementary schools, instead, largely use standardized testing data (Stanford or Metropolitan) coupled with teacher recommendations to determine individual student placement. Secondary schools use the individual records as references to see which courses have been completed, final grades obtained, etc.

In the Final Report of the Mathematics Program Evaluation (p. 53), 86% of the teachers responding stated that the Individual Mathematics Record was either of no value or that they maintain the record but do not use it.

6. Eliminate offering of Introduction to Algebra in grade 6. Replace the offering with a more comprehensive course, Advanced Unified 6, to be developed for highly capable students. (The curriculum guide would be developed jointly with Gifted/Talented/Advanced Programs Office.)

Supportive rationale:

The mathematics curriculum for highly capable students is already in place for grades 4 and 5. The formation of Advanced Unified 6 would be a natural linkage between grade 5 curriculum for highly capable students and Advanced Unified 7 which is currently taught at all middle/junior high schools.

The title "Introduction to Algebra" has been viewed too much as an automatic stepping stone for Algebra I at grade 7.

Sixty-seven percent of the middle/junior high school teachers responding stated that Introduction to Algebra does not adequately prepare students for Algebra I in grade 7. The primary reason cited was the lack of basic skills. Eighty-three percent of the elementary school teachers responding reported that they did not have time to complete the outline for Introduction to Algebra ((F.R. p. 25). It is impossible to thoroughly teach the course when two or three mathematics groups exist within a single classroom.

The course "Introduction to Algebra," is more narrow in scope including an emphasis on solution of equations and introduction to functions. These topics could well be delayed. We concur that a more comprehensive, challenging mathematics course giving more experiences with fractions, decimals, integers, percents, measurements, and statistics would provide the student with a better mathematics background needed for either Advanced Unified 7 or Algebra I in grade 7.

7. Review the criteria used for placement of students in Algebra I, grade 7. Establish a staff committee to determine appropriate selection procedures to be in place for school year, 1986-87.

Supportive rationale:

The screening criteria for Algebra I in grade 7 were changed to reflect a score of 85th percentile or above on the CAT, effective fall of 1983. This has helped considerably to ensure more appropriate student selection. However, we feel that the screening procedures still need more refinement. The student selected for this course should be more than just "highly capable" in mathematics; he should demonstrate a high aptitude, interest, and maturity in mathematics before beginning this academic sequence at this early age. For these students, we feel that Algebra I should remain as an available offering.

Note that students beginning Algebra I as 8th graders still finish Calculus in their senior year.

We emphasize the fact that staffing will be a problem for "small classes" at grade 8 in the middle schools and grade 9 in the junior high schools. Where the number of students involved are insufficient to justify a separate class, we recommend that either additional staffing be provided or that the students be scheduled for the particular course at the feeder high school.

The number of students enrolled in these courses will be affected by two factors:

1. More effective screening.
2. Recent State Department of Education ruling eliminating Credit by Examination.

**STAFF DEVELOPMENT**

8. Expand inservice opportunities for teachers to include greater emphasis on:

   a. Problem solving at all grades and for all ability levels.
   b. Statistics.
   c. Instructional techniques for remedial classes.
   d. Effective uses of curriculum guides.
   e. Improved student performance on standardized tests.

Supportive rationale:

The Mathematics Resource Team is being increased from three to four. They will be providing services within the local schools and in the Mathematics Resource Center.

Specifically, we propose to use the federal funds for mathematics available in fall, 1985 to inservice primary elementary teachers, K-2, in the use of the newly developed curriculum guides for those grade levels.

A new MSDE workshop in statistics will be planned for summer of 1986.

Problem solving is an ongoing emphasis which permeates all our efforts to improve mathematics instruction.

9. Continue to emphasize the effective use of instructional time by encouraging the "active teaching" approach.

Supportive rationale:

This model is based on sound research and has proven to be effective in terms of student performance on standardized tests. The model de-emphasizes the amount of time spent on homework review, but concentrates on active concept development with the students, assessment of the objective(s), and sufficient skill reinforcement during scheduled review sessions. The schools that are involved with this model feel that the specific time allotments for the model components have produced very positive effects in student learning.

10. Incorporate the use of calculators and computers as instructional tools into mathematics classes at all ability levels.

Supportive rationale:

We feel there has already been much progress made in this area. We will continually explore the possibilities for ways in which the new technology can enhance the mathematics classroom. There are some topics which have become "obsolete" due to the technology such as finding square roots by the long method, interpolation for logarithms, etc. The calculator and computer are "time savers" for computations allowing more time to be spent on the thinking processes. Examples: finding compound interest, curve sketching, etc.

**OTHER**

11. Increase minority participation in mathematics classes for highly capable students beginning in elementary school.

Supportive rationale:

We recognize that this problem is not limited to mathematics and that the Board of Education has already hired personnel to address this concern. We will work with the task force and with guidance counselors to ensure that students are encouraged to enroll in classes commensurate with their ability.

I will explore this issue with the National Council of Teachers of Mathematics officials to see if there are any programs which have proven effective in this area.

12. Promote departmentalization as the model for mathematics instruction in elementary grades at the intermediate level.

Supportive rationale:

We feel that teachers will have more time to prepare effective lessons if they are not responsible for teaching all the subjects normally taught by an elementary school teacher.

The content in mathematics has become more sophisticated with emphasis going far beyond computational skills. Therefore, if a teacher has an inclination toward mathematics, his expertise should be drawn upon to support the mathematics instruction for more than one group of students. Conversely, if there is no teacher(s) showing strength in mathematics, it is easier to train a few than all.

********

Thank you very much for your consideration of these recommendations. The evaluation process has proven to be lengthy, but rewarding.

Respectfully submitted,

Cleo Campbell

Cleo Campbell
Coordinator of Mathematics

CC/mbt

## MATHEMATICS PROGRAM EVALUATION
REACTION SHEET

**Directions:**

Please place a check mark (✓) in the appropriate column. Use the back of this sheet (attach additional sheets if desired) to write any comments you may have. Please organize your comments BY NUMBER to correspond to the number of the recommendation being addressed.

| | AGREE | DISAGREE |
|---|---|---|
| **CURRICULUM** | | |
| 1. Content-descriptive course titles (General program) | | |
| 2. Current academic program | | |
| 3. Computer Mathematics curriculum | | |
| 4a. Scope and Sequence Revision | | |
| b. K-8 curriculum guides | | |
| 5. Mathematics Inventory Record | | |
| 6. Introduction to Algebra (Grade 6) | | |
| 7. Algebra I (Grade 7) | | |
| **STAFF DEVELOPMENT** | | |
| 8. Expand inservice opportunities | | |
| 9. Effective use of instruction time | | |
| 10. Technology | | |
| **MISCELLANEOUS** | | |
| 11. Minority participation | | |
| 12. Departmentalization (Grade 4-6) | | |

The following information will be used to determine the amount of reaction input provided by :

___ Principal
___ Mathematics teacher (Individual)
___ Mathematics staff (department)
___ School-wide staff
___ CAC
___ PTA
___ CRASC

Please check one of the above to indicate the reactor(s).

**REMINDER: Please return to the Mathematics Office by May 9, 1985.**

REACTION SHEET SUMMARY

| | 1 | | 2 | | 3 | | 4a | | 4b | | 5 | | 6 | | 7 | | 8 | | 9 | | 10 | | 11 | | 12 | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | A | D | A | D | A | D | A | D | A | D | A | D | A | D | A | D | A | D | A | D | A | D | A | D | A | D |
| INDIVIDUAL TEACHERS | 98 | 4 | 102 | 2 | 143 | 11 | 146 | 9 | 154 | 11 | 143 | 26 | 122 | 14 | 91 | 11 | 155 | 18 | 156 | 4 | 142 | 26 | 130 | 12 | 122 | 30 |
| MATHEMATICS STAFFS | 15 | 0 | 12 | 1 | 15 | 0 | 16 | 0 | 16 | 0 | 16 | 0 | 16 | 1 | 14 | 2 | 17 | 0 | 16 | 0 | 16 | 0 | 14 | 1 | 13 | 1 |
| SCHOOL-WIDE STAFFS | 21 | 0 | 21 | 1 | 25 | 1 | 26 | 1 | 27 | 0 | 25 | 0 | 25 | 1 | 20 | 1 | 24 | 2 | 25 | 0 | 26 | 0 | 24 | 0 | 16 | 7 |
| PRINCIPALS | 43 | 0 | 42 | 0 | 48 | 0 | 50 | 1 | 50 | 0 | 49 | 0 | 47 | 1 | 41 | 4 | 50 | 1 | 48 | 0 | 51 | 0 | 48 | 2 | 37 | 7 |
| CAC | 11 | 1 | 13 | 0 | 12 | 3 | 15 | 1 | 12 | 0 | 11 | 1 | 15 | 1 | 15 | 1 | 12 | 2 | 14 | 0 | 11 | 2 | 10 | 1 | 10 | 3 |
| PTA | 3 | 0 | 3 | 0 | 4 | 0 | 6 | 0 | 6 | 0 | 4 | 0 | 6 | 0 | 3 | 1 | 6 | 0 | 6 | 0 | 5 | 1 | 3 | 0 | 3 | 1 |
| CRASC | SEE | | SUP | POR | TIN | G | | STA | TEM | ENT | - | At | tac | hment-C | | | | | | | | | | | | |

10

CRASC Chesapeake Regional Association of Student Councils

November 27, 1984

TO: Cleo Campbell, Coordinator of Mathematics

FROM: Michael Wiggins
CRASC Research Coordinator

SUBJECT: Math Proposals

cc: Dr. Rice
Board of Education Members

Statement of Problem:

Miss Campbell, Coordinator of Mathematics, will be presenting a sequential math curriculum for secondary students involved in general math to the Board of Education. At the request of Miss Campbell, all high school student government associations were asked to submit a position on the proposals.

Background:

On Friday, October 5, Miss Campbell presented this suggested sequence to the CRASC Education Liaison Committee. This presentation was followed by a survey sent to all high school S.G.A. organizations. The survey included the following questions:

1. Does your school favor the sequence as proposed? If not, what are your suggestions?
2. Does your school favor the development of a general math curriculum and sequence?
3. Does your school favor the proposals as a whole?

Survey:

The following schools participated in the survey:

| | | | |
|---|---|---|---|
| Andover | Old Mill | Brooklyn Park | Northeast |
| Glen Burnie | Meade | Arundel | |

The results of the survey were positive on the whole. Students felt the sequence was flexible and allowed them to choose the program they desired. The newly developed general math sequence was also reviewed and the reaction was positive.



-over-

STUDENT AFFAIRS OFFICE ▫ 224-5405 ▫▫ Anne Arundel County Public Schools • 2644 Riva Road • Annapolis, Maryland 21401

The following concerns were raised:

1. Should credit by exam be given before the ninth grade?
2. Will all schools be able to staff these courses effectively?
3. Is there a separate program for special education students?

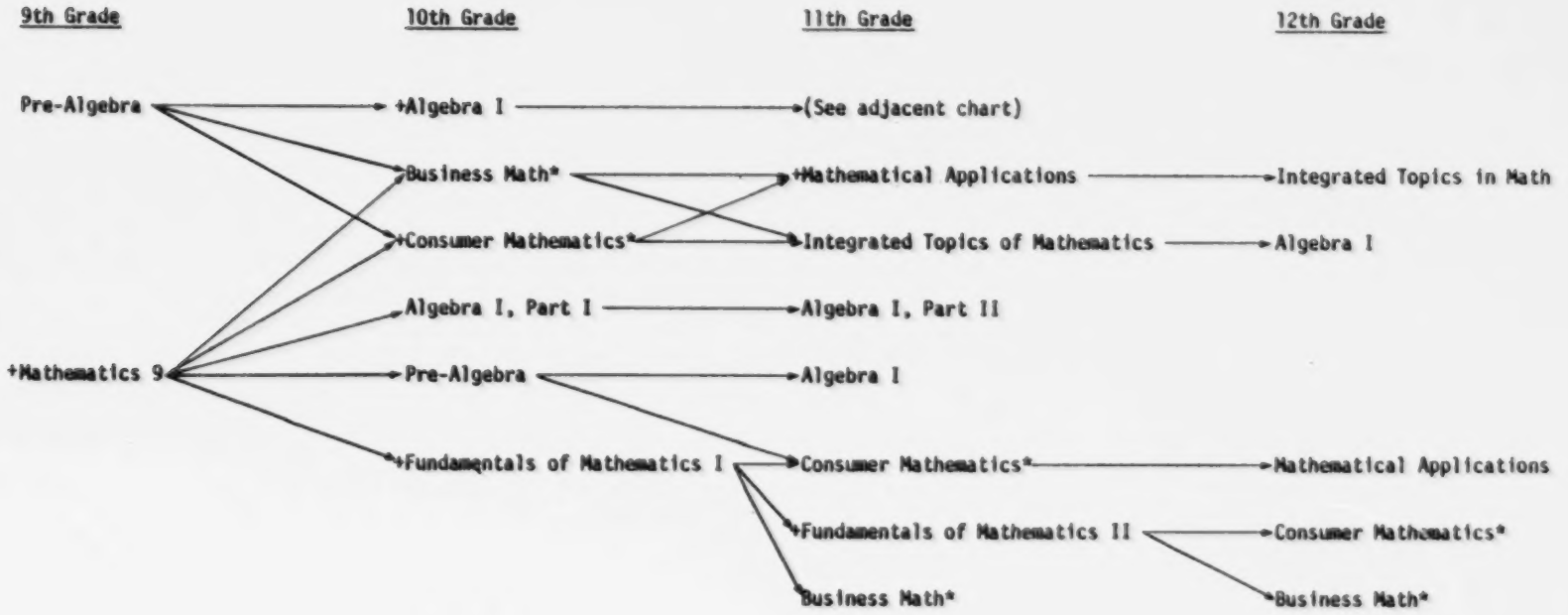
Additional positive comments from CRASC Education Liaison Committee:

1. Agreement with the recent increase in math credit requirements from two to three credits.
2. Agreement with the newly developed curriculum guides.

CRASC recommends that the Board approve the proposals, based on the positive results of the survey.

dab

SUGGESTED SEQUENCES FOR MATHEMATICS PROGRAMS FOR THE GENERAL STUDENT IN GRADES 9-12




*A student may not receive mathematics credit in both Consumer Mathematics and Business Mathematics since much of the curriculum of one overlaps the other. Business Mathematics (Q03000) is offered within the Business Department.

+Core offerings

SUGGESTED SEQUENCES FOR MATHEMATICS PROGRAMS

| 7th Grade | 8th Grade | 9th Grade | 10th Grade | 11th Grade | 12th Grade |
|---|---|---|---|---|---|
| Unified 7 | Unified 8 | Mathematics 9 | GENERAL PROGRAM | | |
| | | | | Algebra I, Part I → Algebra I | Alg. I, Part II → Fused Geometry, Computer I, Math. Applications |
| | | | Alg. I, Part I → Algebra I | Alg. I, Part II → Fused Geometry, Computer I, Math Applications | Fused Geometry, Computer I, Math Applications → Algebra II, Computer II, Math Applications |
| | | Alg. I, Part I → Algebra I | Alg. I, Part II → Fused Geometry, Computer I | Fused Geometry, Computer I, Math Applications → Algebra II, Computer II | Algebra II, Computer II, Integrated Topics of Mathematics → Trig/Analytic Geometry, Algebra III, Probability & Statistics, Computer I or II |
| Unified 7 → | Algebra I → | Fused Geometry → | Algebra II → | Trig/Anal. Geo. → Elem. Functions/ Analytic Geo. Algebra III, Prob & Statistics, Computer I or II | Calculus AB → Calculus BC, Probability & Statistics, Computer I or II |
| Algebra I → | Fused Geometry → | Algebra II → | Elem. Functions/ Analytic Geo. → Trig/Analytic Geo., Computer I or II, Prob & Statistics | Linear Algebra → Algebra III, Linear Algebra, Computer I or II, Prob & Statistics | Calculus (AB or BC) |